Tritium Data Variability at Indian Creek Spillway

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Abstract

Tritium is a weakly radioactive form of hydrogen that occurs naturally and as a byproduct of the operation of Fermilab’s particle accelerators. The levels found in the waters leaving the lab are required to be monitored and are well below regulatory limits. Indian Creek Spillway is a boundary between operational lab waters and waters of the state. A weir marks the exact boundary, and permit requirements include monthly reporting of tritium concentrations and flow volume estimates. This study evaluated sub-monthly variability of these parameters to assist with decisions regarding future monitoring efforts.

In order to examine the potential variability in the volume of water that passes over the weir, an Environmental Protection Department (EPD) transducer was installed one foot below the water at the gate to measure fluctuations in water level. Barometric readings from FESS’s air-deployed barologger were converted from mmHg to feet, and then subtracted from the water levels measured by the EPD transducer to remove the effects of barometric pressure. This corrected data was cross checked with level data from FESS’s levelogger transducer approximately fifteen feet upstream, where the same process was repeated.

Methods

Water samples were taken from Indian Creek Spillway every Friday and Tuesday from June 24th through July 12th. They were submitted to Fermilab’s radionuclide analysis facility (RAF) for tritium concentration analysis (in picocuries per milliliter, or pCi/ml). Total tritium load (in curies) would be calculated by multiplying tritium concentration and total water volume over the Spillway, but at present there is no regulatory limit for total tritium in surface water.

Results

Tritium concentration levels were lowest on June 24th, at 3.8 pCi/mL, and peaked on July 8th, with a high of 12.6 pCi/mL. This is roughly in line with historical monthly data taken at the Indian Creek Spillway. Water levels were plotted as a change from the initial level and varied by 0.195 feet (2.3 inches) at the EPD transducer, and 0.17 feet (2 inches) at the FESS transducer located upstream of the Spillway.

Discussion

Monthly reports track tritium concentration and estimate a consistent flow volume. At a short time scale such as depicted above the flow volume appears variable, but over long periods of time it will have a consistent average due to seasonal weather and operational conditions. In conclusion, Fermilab should only need to consider increasing the frequency and accuracy of tritium and volume measurements if regulatory requirements increase in the future.

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