Contribution ID : **73** Type : **Oral Presentation**

# Improvements to sample processing and measurement to enable more widespread environmental application of tritium measurements

*Tuesday, 27 September 2016 11:00 (0:20)*

## Content

Tritium measurements provide valuable insights into a variety of environmental studies including groundwater hydrology, oceanography, and limnology amongst others. This work describes efforts to use enhanced sample preparation and counting techniques to improve tritium measurement sensitivity in an effort to expand the role of these measurements in environmental studies. Historically, tritium measurements have been assisted by high amounts of anthropogenic atmospheric tritium released by above ground nuclear tests; thereby making tritium from environmental samples less challenging to detect. Since cessation of these tests, atmospheric tritium levels have decreased orders of magnitude from their peak in the 1960's and are now approaching levels of ˜ 2-10 tritium units (TU) in typical atmospheric rainwater. The resulting reduced tritium activity can complicate its effective measurement in environmental samples. In applications including different hydrologic and oceanographic studies, this can be addressed by simply collecting larger samples to compensate for lower tritium activity levels. If needed, these larger water samples can be concentrated using electrolysis under calibrated conditions to increase tritium concentration and thereby enhance ultimate measurement sensitivity and accuracy. In other cases, however, larger samples may not be logistically possible and effective application of tritium measurements becomes dependent upon improved analytical approaches to capture the shrinking tritium signatures needed for to environmental measurements. For instance, applications of organically bound tritium using microbial, plant, or animal biomass may be sample limited making it very difficult to rely on collecting more sample to overcome low starting tritium abundance. Studies focused on specific tissues (e.g. microbial biomarkers, plant growth rings, or specific animal organs) can thereby be restricted without an ability to make tritium measurements at very sensitive scales on small amounts of sample having near atmospheric concentrations of tritium.

Pacific Northwest National Laboratory (PNNL) has developed an ultra-low-background proportional counter method combined with measurement in the PNNL Shallow Underground Laboratory to enable analysis of small, low-activity tritium samples. In conjunction, sample processing approaches are being developed to enable conversion of multiple different types of environmental samples into the methane count gas used for proportional counter-based tritium analysis. Sample preparation follows three main steps: 1) environmental purification of the analyte of interest (biomarker, tissue sample, etc.), 2) combustion of the sample and collection of the resulting combustion water, and 3) chemical conversion of the combustion water to methane for isotope evaluation. These methods are designed to enable effective tritium measurements on less than one gram of modern, environmentally-derived, dry biomass samples at current atmospheric tritium levels.

We will use a demonstration of tritium measurements from a suite of water samples as an example to highlight the methane synthesis and counting approaches for measuring tritium content. Further, we will use this as a foundation for exploring additional uses of tritium in environmental applications.

## About the Presenter

Dr. Moran specializes in analysis of active and stable light isotopes, including those of hydrogen, carbon, oxygen, and nitrogen. He has applied the measurement of these isotopes to a wide variety of ecology, microbial ecology, and forensic applications.

**Primary author(s) :** MORAN, James (Pacific Northwest National Laboratory)

**Co-author(s) :** Dr. AALSETH, Craig (Pacific Northwest National Laboratory); ALEXANDER, Thomas (PNNL); MACE, Emily (Pacific Northwest National Laboratory); Dr. SEIFERT, Allen (Pacific Northwest National Laboratory); BACK, Henning (Pacific Northwest National Laboratory); OVERMAN,

Cory (Pacific Northwest National Laboratory); WILCOX FREEBURG, Eric (Pacific Northwest National Labortory)

**Presenter(s) :** MORAN, James (Pacific Northwest National Laboratory)

**Session Classification :** Applications

**Track Classification :** Applications