**The Extremely High and Transient Gamma Ray Phenomenon:**

**Looking Back on 20 Years of Discovery, Looking Forward to New Applications**

**Terence P. O’Sullivan**

**Vapor Condensation Technologies, LLC**

Well logs from heavy oil development wells in the San Joaquin Valley, California, frequently record high gamma ray (GR) values through intervals of the hot, vapor-filled rock that remains after injected steam, at temperatures greater than 250 degF, displaces heavy oil. GR values that exceed 20,000 GAPI and are 200 to 400 times greater than those in similar, but liquid-filled, rock have been observed. These high GR values occur on open-hole logs through new wells that intersect a steam chamber, after circulation-of-mud while drilling temporarily cools a well, causing hot vapor to condense as droplets within the volume of investigation of the GR tool. After the cooled well equilibrates with the hot reservoir, GR decreases to normal levels. Later, circulation of cool water can regenerate the high GR, demonstrating that the response is transient and reversible.

Observations and experiments that explore the cause, context and behavior of this unique, reservoir-scale transport phenomenon will be presented and applications will be discussed.

**Terry O’Sullivan** is a Petrophysical Consultant with more than thirty years of exploration and development experience.  As a Technical Consultant and lead petrophysicist for Aera Energy LLC from 1997 to 2017, his focus was on the evaluation of oil-in-place and optimization of recovery for existing and undeveloped oil fields in the San Joaquin and Santa Maria Basins. During this time, he developed new technologies for in situ evaluation of heavy oil viscosity using NMR, and he discovered the cause of the transient and high gamma ray response observed in the steam chamber. These technologies are described in patents and SPWLA and other publications. He co-chaired the 2015 SPWLA annual meeting in Long Beach. Prior to Aera, O’Sullivan gained worldwide exploration and development experience at Ampolex (Australia), Maxus (Indonesia) and Unocal (Indonesia and Brea, CA). He has an BA in Earth and Planetary Sciences from Johns Hopkins University, and an MS in Geology from Wright State University.