Since the Partial Test Ban Treaty in 1963, nuclear explosion tests have largely been conducted in underground locations. To monitor the emissions from underground nuclear tests, the world community relies upon atmospheric monitoring for radioxenon among other technologies. The Comprehensive Nuclear Test-Ban Treaty (CTBT) incorporates radioxenon monitoring within International Monitoring System (IMS) with a focus on 131mXe, 133mXe, 133Xe, and 135Xe. It is expected that radioxenon monitoring will also be incorporated into the On-Site Inspection (OSI) protocols.

When an atmospheric radioxenon signal is observed, the isotopic ratios are examined to see if they match the expected values for nuclear explosions. These isotopic ratios are utilized to distinguish between nuclear explosion sources of radioxenon and other anthropogenic sources such as the commercial nuclear industry and the radiopharmaceutical industry. Current methods to predict the various isotopic ratio signatures have largely focused on modeling the production source. While this is a good first order approximation, it does not account for the chemical and isotopic fractionation that occurs during environmental transport of radioxenon and its parent radionuclides. This fractionation causes a significant change in the isotopic ratios from their point of creation to the point where they are collected in the atmosphere.

This seminar will focus on developments at The University of Texas at Austin that advance the field of radioxenon nuclear forensics. Analysis will be shown for both natural and anthropogenic signals and forensic methods for distinguishing between radioxenon sources will be discussed. A forensic assessment of radioxenon emissions from the Fukushima nuclear accident will be presented and results showing the variability induced by underground radionuclide transport will be detailed.

Dr. Steven Biegalski is an Associate Professor at The University of Texas at Austin and the Director of the Nuclear Engineering Teaching Laboratory. He earned his Ph.D. in nuclear engineering from the University of Illinois at Urbana-Champaign in May 1996. Upon completion of his doctoral degree he held a National Research Council Post-Doctoral Fellowship at the National Institute for Standards and Technology. Dr. Biegalski then joined the Center for Monitoring Research in Arlington, VA where he was Director of Radionuclide Monitoring. He joined the faculty of The University of Texas at Austin in 2002. Dr. Biegalski is licensed as a Professional Engineer in the states of Texas and Virginia. His research focuses on nuclear analytical methods, nuclear instrumentation, radioxenon analytical methods, and nuclear forensics. He has experience modeling environmental pathways and has worked to develop technology in support of nuclear treaties. While employed at The University of Texas at Austin, Dr. Biegalski has been awarded 43 research grants totaling more than $11 million in research. Dr. Biegalski has written two book chapters and is an author on 155 peer-reviewed publications.

Dr. Biegalski is a finalist for position of Jerry and Tina Grandey University Chair in Nuclear Science and Engineering.