Graded Safeguards Tables, Materials Attractiveness, and Bare Critical Mass

Abstract: The security of nuclear materials is the responsibility of governmental regulators. Typically these regulators follow the recommendations of the IAEA as set forth in IAEA NUCLEAR SECURITY SERIES No. 13, entitled, “Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities,” a.k.a. INFCIRC/225/Rev. 5. The security postures for various nuclear materials are summarized in a graded safeguards table (GST); namely, Table I on page 20 of INFCIRC/225/Rev. 5. In the USA, the regulators are the U.S. NRC and U.S. DOE. The latter organization has published its own GST (Table C in DOE O 474.2 Chg. 4, 9-13-2016), which has some significant deviations from the IAEA GST. To understand the rationale behind these differences one must understand material attractiveness and the role the bare critical mass plays in material attractiveness. This talk will define those material properties that make a material attractive for use in a Nuclear Explosive Devise (NED) by a sub-state actor. Furthermore, plausible, scientifically based explanations for some of the features of the US DOE GST will be provided.

Biography: Dr. Charles G. Bathke retire from in NEN-5 Nuclear Design and Risk Analysis Group in October, 2018. He worked on the Advanced Fuel Cycle Initiative (AFCI) and its predecessor the Accelerator Transmutation of Waste (ATW) from 2000 through 2004, where he developed the Nuclear Fuel Cycle Simulation (NFCSim) code, which simulates the civilian nuclear fuel cycle from cradle (mine) to grave (waste repository). Bathke has been with Los Alamos since 1978, performing systems analyses of reactors based upon various magnetic fusion confinement schemes, proton accelerators used to generate tritium, electron accelerators used for x-ray radiography, and terrorist-induced biological events. For the past twelve years, his focus has been material attractiveness and non-proliferation. He was a participant in the first Nuclear Security Working Group (NSWG) Goal 9 study with the Japanese, and is currently a participant in the second NSWG Goal 9 study. He has been a contributor to a section entitled, “Material Attractiveness,” in Handbook of Nuclear Engineering, Vol. 4, edited by Dan Gabriel Cacuci, Springer, Berlin 2010 and to the IAEA’s Physical Model: Volume 9 Spent Fuel Management and Disposal in 2017. He also has several publications on material attractiveness.

(Awards)
- He received the American Nuclear Society, Isotopes and Radiation Division, Best Student Contributed Paper Award in 1974.
- He received the American Nuclear Society, Fusion Energy Division, Outstanding Technical Accomplishment Award in 1994.
- He received the Los Alamos National Laboratory 2008 Distinguished Performance Award for his work on “SNM Attractiveness Analysis for Next-Generation Nuclear Power”.

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