# Fate of energetic compounds as influenced by environmental conditions

K. DONTSOVA[1]*, S. TAYLOR[2], C. QIN[1], E. HUNT[1], Y. WANG[1], M. BRUSSEAU[1], J. SIMUNEK[3], D. TROYA[4]

[1]University of Arizona, Tucson, AZ 85721, USA (*correspondence: dontsova@email.arizona.edu)
[2]Cold Regions Research and Engineering Laboratory, Hanover, NH, USA (Susan.Taylor@erdc.dren.mil)
[2]University of California, Riverside (jsimunek@ucr.edu)
[3]Virginia Tech, Blacksburg, VA, USA (troya@vt.edu)

Insensitive munitions (IM) deposition on the training grounds as a result of low-order detonations during training activities provides a source of IM constituents and their transformation products that can potentially result in contamination of ground and surface water. In order to quantify potential environmental impact it is important to determine how fast these constituents dissolve, what daughter compounds are produced and at what concentrations, and how they react in the soils as influenced by environmental conditions. This study is focused on dissolution of insensitive munitions (IM) constituents DNAN (2,4-dinitroanisole), NTO (3-nitro-1,2,4-triazol-5-one), NQ (nitroguanidine), and RDX (1,3,5-hexahydro-1,3,5-trinitro-1,3,5-triazine) from solid energetic residues, photo-transformation of these constituents under natural sunlight, properties of potential photo-transformation products, and fate and transport of parent and daughter compounds in soils.

After several years of exposure, more than half of NTO was dissolved form the particles, but much smaller amounts of other compounds. Based on current rate of DNAN dissolution we predict that 1 g particle can persist in the semi-arid environment for up to 100 years, making it vulnerable to photo-transformation, while much faster dissolution is observed under wetter conditions. We detected a number of DNAN photo-transformation products in the leachates, but no products of transformation of other IM constituents (inorganic N compounds were detected but their concentrations were not significantly different from control).

We postulate that for soluble compounds dissolution dominates their behaviour, while for less soluble DNAN prolonged exposure to sun promotes photo-transformation.