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Dimitris KALDERIS

## UNCERTAINTIES AND OPPORTUNITIES FOR THE POST-WAR MANAGEMENT OF LAND CONTAMINATED WITH EXPLOSIVES

A closer look on the conflicts around the world in the last 80 years, reveals one hidden victim, the natural environment. Until now, none of the explosive substances ever synthesized considered the post-war environmental impact. None of TNT, HMX, RDX, PETN and their combinations, were manufactured taking into consideration their ecotoxicity, biodegradability or zero-waste principles.

Consequently, there is a large number of sites contaminated with residues of explosives and their transformation products, several decades after ammunition were dropped on them. These sites may be located in urban, peri-urban or rural areas. Apart from their explosive nature, these residues show high toxicity and some types have been classified as potential human carcinogens. To further complicate the issue, explosives residues show increased environmental persistence and contamination appears as hot-spots, with irregular horizontal and vertical distribution in the soil. The rate and extent of transport and transformation will be governed by the physico-chemical properties of the explosive compounds, environmental factors, and biological factors including the presence or absence of explosives-degrading microorganisms. All these factors, create large uncertainties in sites contaminated with explosives.

Are there any alternatives? Can eco-friendly explosives be developed and used?

It is clear that in the explosives manufacturing industry, what matters is the performance of the material for the purpose for which it was designed. The detonation velocity, density, detonation pressure, water resistance and sensitivity are only some of the material properties the industry focuses on. The research community is looking into the development of the new generation of explosives that leave no residues after the explosion and cause reduced environmental damage, without compromising their performance.

This keynote speech will assess the uncertainties involved in post-war contaminated sites and review the current efforts to develop eco-friendly explosives.