Environmental Fate of White Phosphorus/Felt and Red Phosphorus/Butyl Rubber Military Screening Smokes

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Abstract: Investigations were conducted to identify those processes that control the loss and movement of White **phosphorus**/felt, **Red phosphorus**/butyl rubber, and their combustion products in air, soil, and aquatic environments. The fate of RP/BR will be controlled by oxidative transformation. In air, half- lives of 1.8 years were found while in aerated water, the half-life approach 3 years and was found to be dependent on both particle size and oxygen concentration. In soil, the transformation was limited by oxygen diffusion and half-lives into the thousands of years were projected. The oxidative transformation and combustion of WP/F and RP/BR lead to the formation of linear condensed polyphosphates, (P10P22), phosphoric acid, phosphorous acid, hypophosphorous acid, and phosphine. The linear polyphosphates hydrolyze rapidly at low pH (t1/2 = 2 days) which is expected in the aerosol phase. In a neutralized state, the polyphosphates are subject to slow chemical hydrolysis (t1/2 = 100 days). Microorganisms will hydrolyze linear polyphosphates in soils and water with half lives of 15 days in systems containing 100,000 organisms/ml (gm). Cyclic meta -phosphates (tri-, tetra-, and (hexa-) are formed from the linear polyphosphates in aqueous solution and are stable to chemical hydrolysis (t1/2 = 3 years). However, microorganisms can utilize these compounds as a phosphate source with a half-life of 20 days.

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