

## Abstract

This paper used price volatility data sourced from the Institute for Rare Earths and Strategic Minerals as a proxy for aggregate risk to select magnesium from a list of critical raw mineral candidates with the intent of investigating its supply-chain characteristics during the COVID-19 pandemic. This was accomplished to then harmonize with a disaggregated risk framework, based on a retooling of a project finance risk framework by Farrell[1], to generate a series of potential attack vectors that a theoretical opponent could use to induce risk in magnesium-related supply-chains, reducing operational efficacy, as a method of attacking European critical infrastructure. The theoretical opponent was constructed, and their behavior was defined, using offensive realism as a framing for their motivation and actions. The disaggregated risk framework that was created identified four main classes of risk: political risk, market risk, operating risk, and technology risk. These classes of risk and their sub-classes were then utilized to identify five different attack vectors that a state actor could use to deliberately induce risk in magnesium and magnesium-adjacent supply-chains to increase specific or aggregate risk. These five attack vectors were the denial of physical assets in upstream, downstream, and midstream elements of the supply-chain; leveraging sovereign risk to either extract actors from contractual obligations or using contractual risk to force a counterparty to surrender sovereignty; cyberattacks, particularly against midstream infrastructure; the policy and structural dumping of magnesium supply on to the open market; and inducing political instability through covert action for strategic gain.