

**Cole Kostelac, Ashley Raster, Matthew Resz, Taylor Loftus,
Mark Jewell, Samuel Foster, Zach Lassman, Emily Evans**

Missouri University of Science and Technology

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High Temperature Lead Cooled Fast Reactor for Advanced Drilling

Conventional methods for subterranean tunnel construction typically utilize mechanical drilling, explosives, or a combination of the two. These processes can decrease in efficiency with different types of rock and with increased depth, size, and temperature. A sufficiently advanced drilling technique could be used to solve many of mankind's problems. Easy construction of tunnels would allow for underground living areas, transportation systems, mining, nuclear waste disposal, geothermal power and more on a scale not possible with today's slow and uneconomical drilling systems. Perhaps the most promising alternative drilling system uses a method known as "litho-fracturing", the process of using a superheated drill bit to melt its way through solid rock. The molten rock then escapes into fissures in the rock created by the force of the drill bit, leaving behind a tunnel reinforced by resolidified rock as it moves. This novel process was first investigated by Los Alamos National Laboratory in 1971. From their study and electrically-heated prototype, they concluded that such a process could be used for large diameter drilling. They also identified nuclear power as an attractive and compact method of heating the drill bit. This work represents a preliminary analysis of using a Lead Cooled Fast Reactor (LFR) to meet the heating requirements of such a system.