Recently there is a heated debate about whether mining, more specifically, pumping water into the rocks, is increasing earthquake frequency. The government, is trying to encourage a slow use of natural resources, and suggests that the activities during mining may cause the earthquake frequency to increase. The industry, who is looking for the profit, insists these two events have no correlation. As a poor physicist, you are forced to model and explain this process. You have no idea where to start, so you ask Professor Refael for advice. He suggested to you a simple harmonic oscillator model. While at rest, we have:

\[ kx_0 \leq \mu_s N \quad \text{With} \quad \frac{dx_0}{dt} = u \quad \text{and} \quad u \text{ is a small velocity that models the creep of fault lines.} \]

When the stress on the fault exceeds static friction, a motion ensues with the EOM:

\[ m \ddot{x} = k \left( x_0(t) - x \right) - \mu_k N \]

Now the pressure is on you. You have to consider mining’s impact on this model. Several ideas: when you dispose water in the system, both static and kinetic coefficient of friction \( \mu \) may decrease for a limited time. However, the water build up may increase the pressure in the system as well. This makes the problem more interesting, since both the “spring constant” \( k \) and the normal force \( N \) could be affected. The combination of these effects could be one of the following:

1. Increase earthquake frequency.
2. Decrease earthquake frequency.
3. Doesn’t affect earthquake frequency.

Please use simple physics arguments and intuition to modify the model to take into account disposing of water in wells. What is the likely scenario? Also, if earthquakes do result from the water disposal, how do they compare to naturally occurring earthquakes in the fault?