Will Through-the-earth (TTE) communications work in an underground coal mine refuge alternative?
Overview of TTE communication systems

- 5 year NIOSH communication and tracking modeling and performance project
- Two types of MINER act compliant TTE systems

Magnetic field

Electric field
A diagram of an electric field TTE system deployed on the surface.
Warrior Met Coal’s Mine No. 7 - Alabama - Sept 18th

West Portal ~1860’ deep
Ground impedance should be low for electric field TTE systems

- Impedance must be measured at the site
- Transmission frequency affects the measured impedance

For this mine:
- Surface antenna – Eight 4-foot rods per electrode, 20-30 ohms
- UG antenna – 4 rods and 8 roof bolts per electrode, 5-15 ohms
Surface

Antenna Volts

Underground

AMP Volts

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60 Hz Noise
300 Hz Noise
420 Hz Noise
660 Hz Noise

TTE Signal

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Underground signals detected on the surface with a TX current of 1 amp

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Summary

- **Conducted 4 types of measurements**
  1. Noise – 60 Hz and odd order harmonics were the strongest interference
  2. Signal power level – transmit signal received as low as 1 amp
  3. Signal frequency – antenna impedance varied with frequency
  4. Text messages – banner text messages were successful

- **TTE signal detected in both directions diagonally through approximately 1900 feet of overburden**

- **Future Work**
  - Electromagnetic interference (from electrical distribution systems)
  - Conduct electrode separation measurements
Questions?

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