

**Contract No.: B2532535**

**Technology: Crosshole Seismic**

**Contractor: Blackhawk, a division of Zapata Engineering**

**Summary of technology:**

The crosshole seismic method utilizes a pair of boreholes. A string of hydrophone receivers is lowered down one borehole and a seismic source is lowered down the other. With this method, coal seams and voids can be detected by their seismic wave velocity contrast with the surrounding strata. Typically, coal seams and voids are indicated by low velocity zones, while surrounding rock strata, such as sandstone, are indicated by higher velocity zones. Seismic data is collected with the source and receivers in various positions to provide optimum seismic raypath coverage. The seismic source can be created by an air-gun instrument or an electronic vibrating source.

**Stated limitations of technology:**

The presence of high velocity layers above and below the coal seam provides faster routes of travel for the seismic waves than through the coal seam. This may mask the low velocity coal seam and voids. Also, the presence of water in the mine voids can result in poor velocity contrast between the coal and the water-filled voids.

**Field demonstration results:**

<b>Field Demonstration Conditions</b>	<b>Goal of Demonstration</b>	<b>Results of Demonstration</b>
Flat open field on the surface. A series of six boreholes provided multiple source-receiver combinations. Average borehole spacing was 200 feet.	Locate old water-filled mine entries between the boreholes at an approximate depth of 250 feet.	Unsuccessful - no mine voids were detected. The contractor claims that high velocity layers above and below the coal seam were faster routes of travel for the seismic waves than through the coal seam, masking the low velocity coal seam and voids. See report for more details.  Although the crosshole seismic test itself was not successful, data from additional geophones placed along the ground surface (Reverse Vertical Seismic Profiling) was processed and provided a good indication of the presence of mine voids.