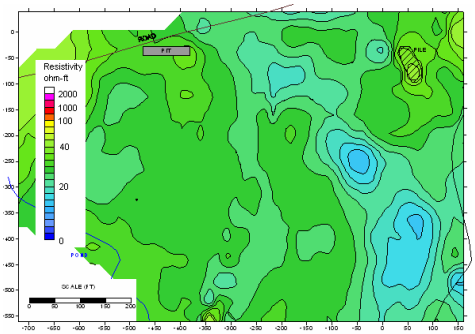
GEOPHYSICAL CHARACTERIZATION OF FINE COAL REFUSE

Fine coal refuse is a waste material collected from the process water used to clean fine and coarse coal at coal processing plants. In past decades, the coal recovery process was not as efficient as it is today and some of the older refuse has the potential to be an important source of fuel. The La Belle property is a large disposal area where fine coal refuse has been pumped to several large slurry ponds. One of the ponds was selected as a test site to determine the effectiveness of geophysical techniques in evaluating the suitability of the fine coal refuse as a fuel.

Conventional evaluation requires extensive drilling, sampling and laboratory testing for determination of the physical characteristics of fine coal refuse, especially BTU content. This is typically not an easy task because of ponded water and soft surface conditions that can make access extremely difficult. Because of the problems normally associated with conventional investigations, D'Appolonia performed a test program to determine if non-intrusive geophysical testing could potentially facilitate the characterization of coal refuse.



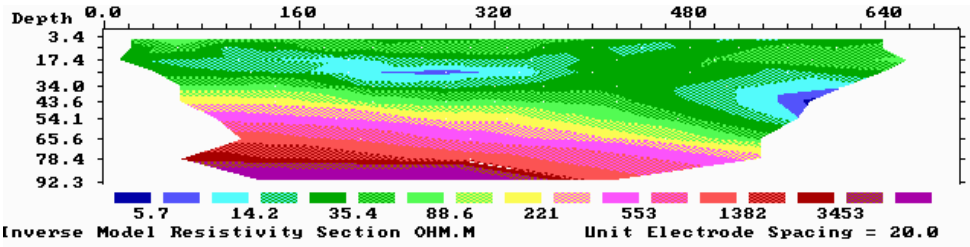
Distribution of shallow ground resistivity from EM-31 measurements.

Because the chemical composition of surface soil is frequently reflected as variations in electrical properties, electromagnetics (EM) and DC resistivity were selected as the geophysical methods to be employed for the test survey. The EM method can rapidly map lateral variations of electrical properties, whereas the DC resistivity method can map these variations with depth.

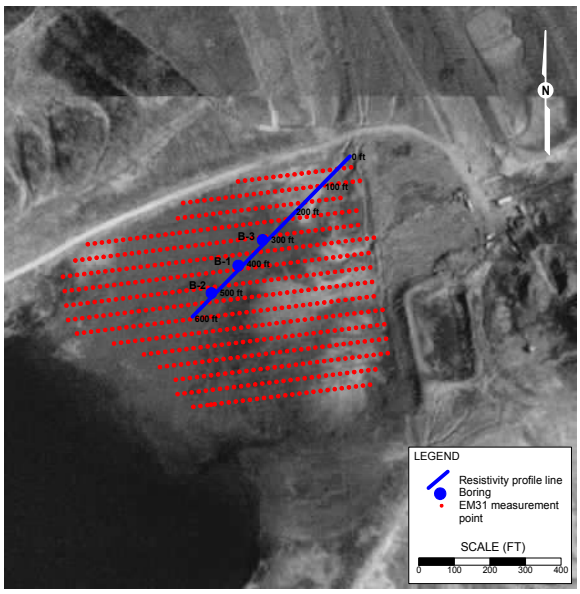
The La Belle property was initially surveyed with a Geonics EM-31, an EM device that measures bulk electrical properties to a depth of approximately 20 feet. A DC resistivity profile was then obtained using a dipole-dipole electrode configuration, and the data were modeled as a cross section with the 2DRESINV software.

As shown on the figures, the EM-31 results define a variation of the resistivity in the coal refuse in the range of 10 to 25 ohm-meters. The pattern of the changes is one of broad arcs of different materials probably related to the piping of the slurry from the east. The DC resistivity profile shows the variation of resistivity with depth and also indicates a thickening of the material towards the center of the slurry pond.

Once the distribution of resistivity had been determined from field measurements, the next step in the investigation was to compare these values with BTU values determined from the laboratory measurement of representative samples.

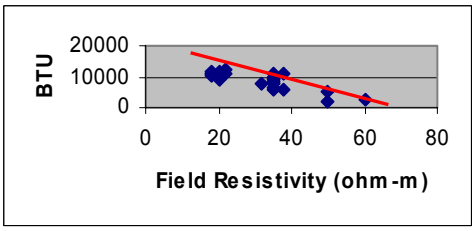


E-W resistivity profile across fine coal refuse lagoon. The base of the coal refuse in contact with bedrock is clearly visible (approximately the yellow line), and the variations in resistivity identified from the EM-31 can be observed as a function of depth.



Location of EM measurement points and resistivity profile at one of the La Belle property slurry pond.

Three borings were drilled to the base of the fine coal refuse at locations along the profile where the resistivity study was conducted. These borings confirmed that the depth to the bottom of the slurry pond was consistent with that determined from the DC resistivity technique. Based upon laboratory testing, the BTU values of the samples were found to correlate well with field resistivity values. Ash content was found to be inversely proportional to the field resistivity. Other parameters such as percent passing the 200 sieve and percent sulfur were found to have little correlation.



Correlation of BTU values from laboratory testing with field resistivity.

The overall results of the study were encouraging and suggest that geophysical techniques can be utilized to characterize fine coal refuse and could be a useful tool to guide the planning of coal refuse recovery operations.