September 5, 1985

C. C. Johnson & Associates, Inc.
11 East Adams Street, Suite 1100
Chicago, Illinois 60603
ATTN: Sidney F. Paige, Site Manager

RE: Proposal for Geophysical Surveys at
Industrial Excess Landfill
7777-157-WP1-WKPLN

Dear Mr. Paige:

This letter is in response to our various telephone conversations and my subsequent review of the Work Plan (Volume I) for the Industrial Excess site. The geophysical techniques proposed to be employed at this site have been utilized by myself at similar sites and situations with acceptable results. I am confident that the techniques which are described latter in the text can be of use, in particular in meeting the objectives of the remedial investigation.

A review of the geology and geohydrology portion of the Work Plan indicates that the substrate materials are both varied and complex. Since the site is located in a glaciated portion of the state which are characterized by kames, eskew, and moraines, any contaminant migration may vary horizontally and vertically over relatively short distances. This is complicated by past operations of the site for mining and the alleged presence of a mine shaft beneath a landfill. It is therefore imperative that data be gathered concerning contaminant migration and subsurface geology via geophysical techniques. This will maximize data collection efforts by wells and/or borings.

The following is a brief outline of what geophysical techniques will be implemented and utilized at the site. All recommendations are based on materials contained in the Work Plan and telephone conversations with yourself. These recommendations may change after work begins as the site, due to logistics or quality of the data collected.

Initially I believe the site should be approached (geophysically) to meet the following objectives:

- Horizontal and Vertical Extent of groundwater contamination (if any);
- Identify stratigraphically the overburden and bedrock;
- Identify potential migration pathways of contamination.
This will be accomplished by performing signature recognitions with the various geophysical techniques. Each technique will be utilized at a location where subsurface geology is known and/or contamination is present. The techniques to be utilized will be terrain conductivity, resistivity, and seismic.

**Terrain Conductivity**

The terrain conductivity portion of the survey will be performed with both the EM31 and EM34-3 Terrain Conductivity Meters. The EM31 has a maximum depth exploration capability of 6 meters, while the EM34-3 has a maximum depth exploration capability of 60 meters. It is anticipated that the EM31 will be used in the lower elevation portions of the site (South and East). The EM34-3 will be used on all portions of the site. The use of the two (2) different instruments is necessitated by the depth to the water table and the thickness of overburden.

It is anticipated that after a signature is recognized at known points, two survey lines will be performed on each side of the site. Measurements will be made in 60 foot increments on each survey line to coincide with the anticipated grid. Each survey line will be a minimum of 120 feet apart, again to coincide with the anticipated grid.

At each measurement station a minimum of two (2) readings will be taken to correspond to the appropriate depth of exploration (to a maximum of 30 feet). This will allow conductivity changes at depths to be assessed, hopefully yielding the areal extent of contamination at selective depth(s).

**Resistivity**

After the terrain conductivity surveys are completed, resistive soundings will be performed. Soundings will be performed in the vicinity of a boring or well where subsurface conditions are known.

A minimum of two (2) soundings will be performed on each side of the landfill. The resistivity soundings will be performed with the Bison 2390 Resistivity Meter and the Barker-Bison Offset Sounding System (BOSS). The BOSS allows for rapid vertical soundings to be performed to a maximum electrode spacing of 256 meters (840 feet), which is more than sufficient since bedrock is estimated to be between 50-100 feet (15-30 meters) below the surface.

It is expected that the vertical resistivity soundings will define both changes in lithology and presence of contamination with depth more accurately than the terrain conductivity.

**Seismic**

After the resistivity is completed, a seismic refraction lines will be performed. It is anticipated that a 6 channel seismograph will be leased for this portion of the survey. The source for the compressional wave will be a hammer and plate. This source usage is necessitated by the presence of methane gas at explosive limits within the substrata. I believe that
explosive sources may inadvertently cause the gas to react. At least four (4) separate survey lines will be performed to explorative depths where bedrock is interpreted to exist. This seismic test will hopefully define substrate changes (velocity) in materials and will not be masked by contaminants as the resistivity may be.

All of the geophysical data will be collected, interpreted and reviewed in the field. After the review is completed, a decision will be made with the concurrence of appropriate personnel to continue the geophysical surveys as described or modify them where appropriate.

The following estimated costs and time are associated with the initial phase of the geophysical surveys. All surveys will require two (2) people to perform. The interpretations portions will require only my time.

<table>
<thead>
<tr>
<th>Sub Task 1</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Terrain Conductivity</td>
<td>4 man-days ($75/hour + $50/hour)</td>
</tr>
<tr>
<td>Resistivity</td>
<td>4 man-days ($75/hour + $50/hour)</td>
</tr>
<tr>
<td>Seismic</td>
<td>2 man-days ($75/hour + $50/hour)</td>
</tr>
<tr>
<td>Interpretation/Review</td>
<td>2 man-days ($75/hour)</td>
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<tr>
<td>Equipment (Seismic) Rental</td>
<td>2,000</td>
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<tr>
<td>Travel</td>
<td>(2 people RT Annandale to Akron)</td>
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<tr>
<td>Travel Expenses</td>
<td>(2 people for 7 days)</td>
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<tr>
<td>Total Estimated Expenses</td>
<td>$15,060</td>
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</tbody>
</table>

This total is a maximum amount and assumes the charges for my time (at $75/hour) plus one other individual (at $50/hour). Costs may be lower, depending on the exact personnel used.
If you have any further questions, please do not hesitate to contact me. I would anticipate that this survey will commence in 2-3 weeks after your concurrence.

Sincerely,

CAMP DRESSER & McKEE, INC.

Wayne R. Saunders  
Technical Operations Team

WRS:dd

cc:  Harry Butler