• DIRECT SENSING
• SAMPLING
• INSTALLATION
• INJECTIONS
What is the Membrane Interface Probe?

The **Membrane Interface Probe (MIP)** is rapid, high-resolution field screening technology that provides information about relative concentrations of VOCs in the subsurface, and the Electrical Conductivity of the soil.

The MIP uses a thin film fluorocarbon polymer membrane approx. 6.35mm in diameter which stays in direct contact with the soil during MIP logging.

- The thin film membrane is impregnated into a stainless steel screen which serves as a rigid support for the fluorocarbon polymer.
- The down-hole, permeable membrane serves as an interface to a detector at the surface.
- Volatiles in the subsurface are getting transferred across the membrane and partition into a stream of carrier gas where they are swept to the detector. The membrane is heated in order to facilitate VOC transfer and self-cleaning.
Membrane Interface Probe (MIP) Setup

- Stringpot
- Field Instrument
- Controller
- GC
  - PID
  - FID
  - ECD
- Trunkline
- GPS System
- Rod String is advanced At 1 ft per min
- Total VOCs
- Detection Limits
  - PID 1 ppm Aromatic Compounds
  - FID N/A Aliphatic Compounds
  - ECD 500 ppb Chlorinated Compounds
- Probe Assembly
- Heater Block and Membrane
- Conductivity Di-pole
Flame Ionization Detector

- Organic analytes are pyrolyzed in an air/H₂ flame
- Ions are produced in the plasma around the flame
  - proportional to number of carbons present
- Positive voltage is applied to collector; negative to the flame body
- Ions migrate to collector producing a current (signal)
Photoionization Detector

- An UV source ionizes all the molecules in the column effluent
- Ions produced are collected resulting in a current flow
Electron Capture Detector

**How it Works**
- Column effluent is passed over a $\beta^-$ emitter
  - Tritium or 63-Ni
- The carrier gas is ionized
- A burst of $e^-$ is produced with each radioactive decay
- Potential is applied between the collector (anode) and the detector body (cathode)
- Produces a constant background current
- The current flow decreases in the presence of analyte molecules
  - The analyte captures the emitted electrons

**Detector Characteristics**
- Sensitive to molecules containing electronegative functional groups (e.g. Cl$^-$)
- Non-linear response to analyte concentration
## MIP DETECTORS

<table>
<thead>
<tr>
<th>Contaminates</th>
<th>Detection Limit</th>
<th>Carrier Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PID</strong> BTEX</td>
<td>1 PPM</td>
<td>Nitrogen, Helium</td>
</tr>
<tr>
<td><strong>FID</strong> Methane, Butane</td>
<td>NA</td>
<td>Nitrogen, Helium</td>
</tr>
<tr>
<td><strong>ECD</strong> Chlorinateds</td>
<td>250PPB</td>
<td>Nitrogen</td>
</tr>
</tbody>
</table>
Production rates: 150’ to 300’ per day.

The production rate of the MIP is affected by:

• the number of logging locations
• the depth of logging
• subsurface conditions
• access restrictions
• probe hole abandonment requirements
• weather
MIP LOGGING
MIP DIRECT SENSING

Pre Log Response

![Graph showing time vs. response with peaks at certain time intervals.](image)

**PRE-LOG RESPONSE**

<table>
<thead>
<tr>
<th>Company</th>
<th>Operator</th>
<th>Site No.</th>
<th>ECID</th>
<th>Compound</th>
<th>Peak Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZEBRA</td>
<td>Walter M</td>
<td>GS#</td>
<td>50</td>
<td>ZEBRA</td>
<td>273301.6 pV</td>
</tr>
</tbody>
</table>
Example of a Microsoft Excel Spreadsheet graphically displaying FID/PID/ECD and Conductivity Logs.
MIP DIRECT SENSING

Post Log Response

POST-LOG RESPONSE

<table>
<thead>
<tr>
<th>Company</th>
<th>ZEBRA</th>
<th>Operator</th>
<th>Water M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project DC</td>
<td>Gulfstream</td>
<td>Client</td>
<td>ZEBRA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tracer</th>
<th>R117/TM</th>
<th>Code</th>
<th>Concentration</th>
<th>Peak Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECD</td>
<td>373035.6 ppb</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Gator
Gator In Action
CPT/MIP
Cone Penetration Testing (CPT)
CPT/MIP

CPT is (Cone Penetration Testing) commonly used to determine the subsurface stratigraphy in-situ and to estimate geotechnical parameters of the materials present in the subsurface.

• Efficiency of technology (lightweight, mobile)
• Innovative cone penetration technique
• Repeatable penetration results
• Cost savings over more traditional boring and sampling methods
CPT/MIP Unit
CPT/MIP Anchoring
ZEBRA ENVIRONMENTAL  CPT/MIP

CPT Response Graph

- Tip Pressure
- Sleeve Friction
- Friction Ratio
- Pore Pressure

Lithology Description
DATA
ZEBRA ENVIRONMENTAL DATA INTEGRATION

SHAREPOINT WEBSITE FOR DATA SHARING
Cross-section from a 2D ECD Fence Slice.
Using 3D modeling software, we can generate true 3D Solid Models. This Plan View model was created using ECD data from a recent MIP project. Any orientation can be displayed and cross-sections or fence diagrams can be created.
North East View

ECD Fence Model

3D ECD Fence Model
3D ECD Solid Plume Model
ZEBRA ENVIRONMENTAL

HPT

Hydraulic Profiling Tool (HPT)
for profiling hydraulic properties of soil

- Fast, Continuous, Real-time Profiling of Soil Hydraulic Properties
- Use in both Fine- and Coarse-grained Material
- Use in both Saturated and Unsaturated Conditions
- Built to Withstand Percussion Driving
- Collects Static Water Level Data
- Provides a Simultaneous Log of Electrical Conductivity with Integrated Wenner Array
New direct push technologies

• HPT Logging
• Rhode Island
Hydraulic Profiling Components
Hydraulic Profiling Tool (HPT)
• Advance probe at constant rate
• Inject water at low flow rate
• Measure formation pressure response
Dissipation Test

SWL = Depth – Static Pressure

52ft – 21psi = 31ft

Flow = 0
ROP = 0

Static Pressure
21psi
Static Water Level

KDHE3 - 5th and Pine - Salina, KS - 4/11/06

Electrical Conductivity (mS/m) vs. Depth (ft)

- Electrical Conductivity (mS/m)
- HPT Pressure (psi)

SWL = Depth – Static Pressure
HPT SOLUTIONS

MW Wells

31 ft

Injection Wells

DPT Injection
Case Study MIP/HPT NJ Site
Case Study MIP/HPT NJ Site

[Image of a device with cables and graphs showing data]
Case Study MIP/HPT NJ Site

FIRST ENVIRONMENT
Former Walter Kiddo Site
Route 21 Associates
Belleville, New Jersey
Case No.: 94-02-28-1619-32
Case Study - HPT VA Site

HPT VA SITE
### Case Study - HPT VA Site

**Flow** - Zero

**Pressure** - High

**EC** - Sand

---

<table>
<thead>
<tr>
<th>Depth</th>
<th>EC (mm/l)</th>
<th>Flow (m/min)</th>
<th>Pressure (PSI)</th>
<th>Flow (m/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>150.0</td>
<td>370.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>3.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>4.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>5.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>6.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>7.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>8.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>9.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>10.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>11.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>12.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>13.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>14.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>15.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>16.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>17.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>18.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>19.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>20.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>21.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>22.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>23.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>24.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>25.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>26.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>27.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>28.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>29.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>30.0</td>
<td>150.0</td>
<td>120.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

---

*ZEBRA ENVIRONMENTAL - 30 N PROSPECT AVENUE - LYNBROOK, NY 1-800-PROBE-IT*
### Case Study - HPT VA Site

**MIF Operator:** Walter Moore  
**Point Name:** HPT4  
**Total Depth:** 28

<table>
<thead>
<tr>
<th>Depth</th>
<th>EC (mS/m)</th>
<th>Flow (ml/min)</th>
<th>Depth</th>
<th>EC (mS/m)</th>
<th>Pressure (kPa)</th>
<th>Flow (ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>1.0</td>
<td>500.0</td>
<td>1.0</td>
<td>150.0</td>
<td>120.0</td>
<td>370.0</td>
</tr>
<tr>
<td>1.0</td>
<td>5.0</td>
<td>10.0</td>
<td>1.5</td>
<td>2.0</td>
<td>150.0</td>
<td>120.0</td>
</tr>
<tr>
<td>2.0</td>
<td>10.0</td>
<td>5.0</td>
<td>2.5</td>
<td>15.0</td>
<td>120.0</td>
<td>370.0</td>
</tr>
<tr>
<td>2.5</td>
<td>15.0</td>
<td>10.0</td>
<td>3.0</td>
<td>20.0</td>
<td>150.0</td>
<td>120.0</td>
</tr>
<tr>
<td>3.0</td>
<td>20.0</td>
<td>5.0</td>
<td>3.5</td>
<td>25.0</td>
<td>120.0</td>
<td>370.0</td>
</tr>
<tr>
<td>3.5</td>
<td>25.0</td>
<td>10.0</td>
<td>4.0</td>
<td>30.0</td>
<td>150.0</td>
<td>120.0</td>
</tr>
<tr>
<td>4.0</td>
<td>30.0</td>
<td>5.0</td>
<td>4.5</td>
<td>35.0</td>
<td>120.0</td>
<td>370.0</td>
</tr>
</tbody>
</table>

**Graphs and Images:**
- Image of soil sample with a coin for scale.
- Multiple images of soil layers with labels for depth and pressure.

(Additional notes on soil composition, test results, and implications can be added here if necessary.)
Case Study - HPT VA Site

Different Radius of Influence
Example – Tampa Bay Site
For more information about the Membrane Interface Probe:

1-800-PROBE-IT

www.TeamZEBRA.com