PREPARATIONS AND REQUIREMENTS GUIDE

DIPOLE METHOD

The Dipole Method for Soil Surveys is:

- Applicable to double geomembrane liner systems for geosynthetic applications (double-lined systems).
- Performed when the top-most, relative geomembrane liner is covered with earthen materials that contain an operations layer depth between 6 to 36 in (15 to 90 cm).
- Conducted on smooth or textured geomembrane floor areas and side slopes that are covered with final graded soil or sediment.

Please note that this guide:

- Includes key preparations and requirements for the electrical leak detection survey.
- Should be reviewed carefully, modified and/or combined accordingly to fit the specifications format per ASTM Standard.
- May be changed, revised, or updated accordingly from time-to-time.
- Is only a reference guide and may not apply to all geomembrane-lined geosynthetic systems or applications.

Please contact **Beyond Leak Detection** for any comments, concerns, or questions regarding the leak detection service or this guide.

The General Contractor shall be responsible for preparing the application for the Electrical Leak Detection Soil Survey using, specifically, the Dipole Method. These preparations and requirements are to:

- **Provide any safety training, site specific training, drug tests, vehicle driving tests or inspections to obtain any clearances.** The General Contractor must provide transportation if technicians cannot obtain a vehicle permit pass for on-site transportation. The General Contractor will be responsible for expenses required in organizing any clearances for technicians to perform the service.

- **Provide an AC source with approximately 110 to 125 Volts and a current capability of approximately 15 to 20 Amps.** A 4,000 Watt portable generator or an outdoor AC outlet would be sufficient and must be within a proximity of 50 ft (15 m) near the edge of the survey area.

- **Provide supervised laborers to assist in the leak detection service during the preparation, survey, or investigation process.** The laborers will be assigned certain duties and responsibilities to assist technicians throughout th entire leak detection service such as, but not limited to, digging holes or trenches, moving objects or machinery that may interfere with the survey, safety patrol, cleanup, etc. Since the “Buddy System” is supported as a monitoring safety measure during the service, at least one laborer is required to work the same hours as technicians and must accompany them at all times while on site. All laborers must be competent, aware, and have knowledge of on-site safety and emergency procedures if an unexpected issue or situation were to occur.
- **Assist in developing a grid or coordinate system throughout the entire application or along the perimeter.** A coordinate system is required to provide survey lanes to help assist technicians from maintaining the intended survey line. The system also provides reference and location coordinates to leaks or anomalies that were located and pinpointed throughout the survey. The coordinate system will be developed on site after assessment of the application. Depending on the type of survey required and the application, this may consist of survey flags, string, twine, rope, sand bags, floating devices, non-toxic marking paint, or other materials to create, develop, or layout the grid or coordinate system. The coordinate system is temporary and will be removed after the survey or investigation process has been completed. The non-toxic marking paint will fade and disappear in direct sunlight after 30 days.

- **Disconnect and remove conductive materials and isolate ground sources that are electrically connected with the operations layer inside the application.** Conductive materials may include metal pipes, cables, wires, ladders, pumps, etc. Ground sources may include concrete structures, batten strips, metal strainers, drains, valves, etc. If feasible, isolating, eliminating, or insulating these conductive current channels will help increase the leak detection sensitivity and minimize masking of smaller leaks in their proximity.

- **Provide a temporary, electrical isolation area, channel, or trench, throughout the entire perimeter of the application (if earthen materials are in contact with the operations layer and surrounding subgrade or earth ground).** This isolation will increase leak detection sensitivity and consists of an area of exposed geomembrane that electrically separates the subgrade material (material underneath the geomembrane and around the perimeter of the application) and the operations layer in the application covering the liner. Excavating or removal of sediment along the perimeter to a minimum width of approximately 6 to 24 in (15 to 60 cm) should be sufficient. Excavation is not necessary if the perimeter around the operations layer has exposed geomembrane.

- **Zone segments of the survey area to prevent technicians from surveying into a restricted, non-required or unintended area.** Depending on the type of survey required and the application, this is accomplished by using survey flags, string, twine, rope, sand bags, floating devices, non-toxic marking paint, or with any type of physical guideline.

- **Wet all layers with consistent saturation above the geomembrane during installation to increase the conduction pathway from the operations layer to the geomembrane and ultimately, through any leaks.** If the layers above the geomembrane are dry, then the layers will simulate an electrical barrier or isolator minimizing the leak detection sensitivity. Therefore, pre-wetting these layers are essential for the leak detection procedure.

- **Wet all layers with consistent saturation prior to installation of the geomembrane (if a geosynthetic clay liner was <u>not</u> installed).** Geocomposites, geotextiles, native soil or sediment, and prepared subgrade will require moisture for electrical contact. Leaks with poor contact conditions will require a continuous, conductive path of moisture or saturated sediment through the geomembrane creating an electrical connection with the underlying conductive material to enable detection.

- **Provide an excavator or backhoe during the process of locating or pin-pointing suspect leaks.** All machines must accompany technicians during the investigation process of locating suspect leaks and must be present during the same hours.

- **Schedule or provide a water truck, source of water, and driver during the leak detection process.** Driver must position water truck so laborers are able to wet the operations layer material. Driver must also refill water truck and may wet areas, if dry, where accessible with the water truck sprayers. Driver must be available at all times during the leak detection service.

- **Verify the operations layer in the application is not frozen, or contain a surface layer of ice.** Technicians cannot perform a survey if the operations layer or earth ground is frozen. Since ice or frozen soil acts as an insulator and current barrier, this would create high resistance during data collection, and leaks would not be detected.

- **Confirm the layering directly underneath the top-most, relative geomembrane to be tested contain a properly-prepared subgrade or medium with sufficient conductivity.** Some conductive mediums are required for sufficient conductivity: conductive-backed geomembranes, conductive geotextiles, a geosynthetic clay liner, or a layer of drainage/filtration soil.

- **Minimize or remove trapped air pockets (aka "hippos" or "ballooning") and wrinkles.** These areas will decrease leak detection sensitivity since an air void is present preventing intimate contact with the underlying conductive layer.

- **Check the layer depth of the operations or soil layer in the application to verify the layer is between 6 to 36 in (15 to 90 cm) during the entire survey process.** Leak signals in areas where the layer may be greater may not be detected due to the leak detection sensitivity. Piles of soil or sediment must be removed or graded for consistent data collection. Leaks under these piles may not be detected.

- **Location and reference marks on the geomembrane must not be erased or covered until the documentation, pinpointing, and repair process is complete.** The documentation process from the leak detection survey will require reference and location marks relative to the location of each anomaly or leak. These marks cannot be erased or covered until the repair process from the repair field crew is complete. Erasing or covering of these marks may compromise the location of the pinpointed anomaly or leak. This may result in a repair of geomembrane in an area where a leak may not be present.

- **Fill the Leak Detection Zone (LDZ) with liquid for best results (if only a geotextile, geogrid, geonet, or geocomposite exists between the geomembranes).** The liquid in the LDZ will be the medium for intimate electrical connection with the electrodes. Since the installation is comprised of two geomembrane liner systems, the volume between the geomembranes must be filled with liquid to provide the conductive material. The conductive material will be energized with an electrode in between the geomembranes during the entire survey period.

- **Fill the LDZ by pumping liquid into the sump riser pipe or into a slit (linear cut) that will have to be made on the top-most, relative geomembrane (if only a geotextile, geogrid, geonet, or geocomposite exists between the geomembranes).** Multiple slits may be required to accelerate the flooding process in between the liners. Technicians are not qualified to cut or penetrate the geomembrane, or repair the cuts or slits once they have been made. The General Contractor will be responsible for cutting or repairing any cuts or slits made during the leak detection process. The level of liquid in the LDZ should be limited so that it exerts a pressure less than the pressure exerted by the operations layer on top of the relative geomembrane to prevent floating.

- **Provide access to place temporary electrodes through the sump riser pipe or through slits (if copper wire electrodes were <u>not</u> installed).** Submersible pumps and electrical cords must be removed from the pipe. If slits were made, technicians may opt to energize the application by placing electrodes in the slits.

- **Install an 8-AWG solid, bare copper wire electrode prior to installation of the top-most, relative geomembrane.** The solid bare copper wire electrode is required to help ensure electrical contact in between the geomembranes. The electrode must not be damaged and must exit between the geomembranes. Access to the wire electrodes will be required during the entire leak detection survey in order to energize the application. The copper wire electrode must be electrically isolated from contacting any material contained in the application or the surrounding earth ground area. If an electrical ground connection is present and isolation is not achieved, false leak signals (false positives) will be detected during the leak detection process and loss in leak detection sensitivity will occur. The General Contractor must contact the Electrical Leak Detection Testing Firm for detailed drawings and installation instructions specified for their application and will be responsible for purchase and installation of the wire electrode.