

## Underliner electrode rapid reading damage detection system – SENSOR DDS™

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**ABSTRACT:** The ecological early warning controlling and monitoring system, SENSOR DDS™ detects damage to impermeable geomembrane liners used for municipal landfills, industrial wastes, tanks, sedimentation basins, storage areas and similar containment facilities.

### HOW THE SYSTEM WORKS

An important factor of the system application is that in order to find out the state of the impermeability of the geomembrane, it is not necessary to measure seepage of a contaminant through the damaged location. Flow of media through the geomembrane is substituted by electric current flow. Thus the leakage can be detected before it could become a source of an environmental disaster.

The measurement itself consists of the data collection in the given locality, analyses and interpretation of data, localization of possible damage and compilation of the final report. The result of processing the measured data is the final report. The result of processing measured data is two-, or three dimensional information on the impermeability of the geomembrane, or possibly, the underlayer of the landfill. Software specifically designed for this purpose is used for interpretation.

The main element in this case is a network of sensors permanently built-in right under the impermeable geomembrane. Their spatial distribution is optimized by computers, in accordance with the building/civil engineering project of the facility under construction, in order to ensure high accuracy of localization of leakage throughout the whole service life of the system.

### ONE EXAMPLE OF ITS SUCCESS IN A CHALLENGING PROJECT

It is very hard to choose the best example because every project completed using this technology was successful. To our way of thinking to find one hole or even ten holes is not so difficult in a short time. The worst situation is the case of a badly damaged geomembrane with many small holes. One such project is described below.

In September 1995 a municipal waste landfill with total area of about 15.000 m<sup>2</sup> was successfully finished. There were several important steps made during the building of the landfill which could significantly influence the result of quality control of the whole construction, the main step the watertightness of the geomembrane.

SENSOR DDS, the technology described briefly above was used to control the integrity of the geomembrane. A grid of sensors and cables was installed under the geomembrane. The whole network was covered by geomembrane, geotextile and drainage/protective layer - gravel. In this case the SHORT version of the Damage Detection System was used with a durability of 5 years. The first measurement of the integrity of the geomembrane was done using standard monitoring boxes and a standard measuring unit. The whole

measurement process lasted about 2 hours. The processing of the field data gathered and interpretation lasted about another 2 hours, i.e. within about 4-5 hours the result of the interpretation - positions of damage - was transmitted from the interpretation center back to the site. The damaged areas were revealed and holes and punctures were repaired. It is obvious that only 1-2 measurements were done in one day. Even if this speed is much higher than some other damage detection systems published or used in the world, in this specific case it was proved to be insufficient. The main reason is that due to very poor control of the installation of the drainage/protective layer as well as the bad quality of gravel used and the geomembrane was badly damaged during this operation. As the development of a new measuring device had just become available, it was used for the following measurements. New data measurement and the acquisition device SENSOR DDS REC can collect together field data from the same area in 3 minutes and several measurements could have been done within one day. Even if the usual 3-5 measurements are necessary to be done to clear the site of any damage (due to physical principles of measurement, „shield“ effect, superimposition of damage and anomalies, ...), decreasing measurement time increases the efficiency of the whole technology. If we can decrease the time necessary for measurement, interpretation, damage repair and issue of a final technical report, the client can begin the operation of the landfill earlier. In specific cases, just like the one described above, where the total number of holes and punctures detected and repaired on about 15.000 m<sup>2</sup> was over 3.000 (!!), it is almost impossible in real time to detect and clean the geomembrane for the repair of each damaged area. Another important reason to use a fast, semiautomatic and precise data acquisition and measuring unit is a higher level of independence. It means that companies operating landfills or other types of environmental projects, or independent quality controlling companies can make a measurement independently, quickly and any time they wish and final data processing, interpretation and the technical report is done in interpretation centers by the engineer-specialists.



Typical damage by caterpillar ↑ and by stones ↓.

