Spontaneous potentials method exploits existence of local geoelectric phenomena and in particular the electro-chemicals generated by contact between conductor means of different nature. These phenomena generate spontaneous potential differences, which measurement is performed through a potentiometer and inserting two non-polarizing electrodes into the ground. Joining on a topographic map points with same potential, a representation of equipotential lines is obtained. Areas where potentials are different from average values indicate anomalies which can be mining fields. This kind of survey does not require introduction of current into the ground and is based on the measure of natural potentials (or spontaneous) due to electro-chemical processes between minerals and fluids into subsoil or to electro-kinetic processes related to ions flows into the ground. They are generated into subsoil by fluids flowing, by bioelectric activity into vegetation, by variation of electrolytic concentration into underground waters. Intensity notably varies but generally is higher than 100 mV also on limited areas. On large scale, the following phenomena related to spontaneous potentials are observed: potential gradient in the range of 30mV/km which can be both positive and negative. Probably it is caused by a gradual changing into spread and electrolytic potential of underground waters. Regional gradient which seems to be related to topography is usually negative and caused probably by electro-kinetic potential (streaming potential). Negative anomalies are observed when passing from open grounds on surface and wooden areas; bioelectric activity of plants sometimes reaches values of few thousand mV.
Four fundamental mechanisms (related to the presence of water into the ground):

Electro-kinetic potential
Spread potential
Nernst potential
Mineralization potential

- **Acquisition modalities**

Instrumentation required by SP method consists in a couple of electrodes to fix into the ground, a cable and a millivoltmeter of high impedance.

Electrodes must be non-polarizing because using metallic electrodes will cause generation of potentials due to electro-chemical action between electrodes and soil. Those potentials cannot be eliminated and can be different according to the type of soil; they also change in time, so for this kind of survey non-polarizing electrodes are necessary.

Non-polarizing electrodes are made of metallic electrodes immersed in a solution saturated of salt such as Cu in CuSO4, included in a porous vessel like ceramic placed in contact with the soil. In this way, asymmetry in electrolytic concentration on electrode is deleted, and copper sulphate allows a good contact between probe and ground.

Also high impedance millivoltmeter must be isolated from soil to avoid that direct contact will cause interferences and measurement errors. Measurements vary between 10 mV and 20 V.

During survey, test can be done with dipolar configuration or keeping a stable base.

In dipole configuration, two electrodes must be moved while spacing between them is fixed, therefore soil mapping according to spontaneous potential is performed. Electrodes are moved in order to occupy with the second the position previously occupied by the first.

Measure of potential gradient can be seen as central with regards to electrodes and caused by mV difference related to distance between electrodes. $dV$ values can be added for the following stations but not for arrays longer than 300 mt because adding $dV$ also measurement errors will be added.

Test can be done also keeping a still referential electrode (-) and moving the other electrode (+) on different measurement stations.

In submerged areas for example, a still electrode can be left on surface while
measurement electrode is dragged on the bed.

Well applications for hydrogeology
Surface applications for hydrogeology