

Detection of a chemical precipitation zone in groundwater by IP-measurements at an industrial landfill area in Helsingborg, Sweden

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Background

Industrial activities have for more than a century been performed at the industrial site of IPOS (Industry Park of Sweden) on the outskirts of Helsingborg, southern Sweden. Especially the activities performed during the first half of the 20th century have severely polluted the site with a number of elements and inorganic compounds. As the industrial site is situated close to the Sound, there is a concern that the pollutants that are accumulated in the groundwater will disperse into the sea. Laboratory experiments have shown that different elements, such as As, Fe and Al, could precipitate as the groundwater, with a pH around 4, is mixed with the sea water, with a pH around 8. To locate the possible precipitation zone in the ground, a geophysical survey was performed.

The survey was performed in the autumn of 2006 as part of a master thesis work at Lund University in cooperation with the consulting firm WSP, who has been working in the area since the late 1970s. A second stage is planned in autumn 2008 as a continued task for WSP.

Geophysical survey

The nature of the precipitation zone, with a high content of metal ions, is such that a rise in electric conductance and IP-effect could be expected. To test this hypothesis a geophysical survey, including resistivity- and IP- (Induced Polarization-) measurements, was performed.

The nature of the survey area, as a working industrial site, demanded some special care. Major parts of the profiles were located on hard ground and holes had to be drilled for the electrodes. Trucks were also circulating in the area, which demanded some precautions during the field work. A lot of pipes, power lines, different metal objects and old building fundamentals were expected in the ground, which demanded the profiles to be located with great care.

Two profiles were completed in 2006 and another three is planned for autumn 2008. The measurements were performed using an ABEM Terrameter SAS 4000 four-channel instrument and Lund cable system. The base electrode distance was 2.5 m and the electrode configuration used was the gradient configuration.

Results

The results from autumn 2006 show that a low resistivity zone is found in one of the two profiles in the area where the precipitation zone is expected. However, this could be an effect of the lower resistivity of the salt seawater. In the same area a zone of higher chargeability is found, see Figure 1. The values here rise from below 20 mV/m in the surrounding ground, to above 50 mV/m. This could be an effect of the precipitation.

Due to the restriction in profile geometry, caused by the proximity of the shoreline, the anomaly is found in the lower margin of the inverted section, which adds some uncertainty in the interpretation. The data quality is also affected by noise from the industrial environment, which especially affects the IP-results.

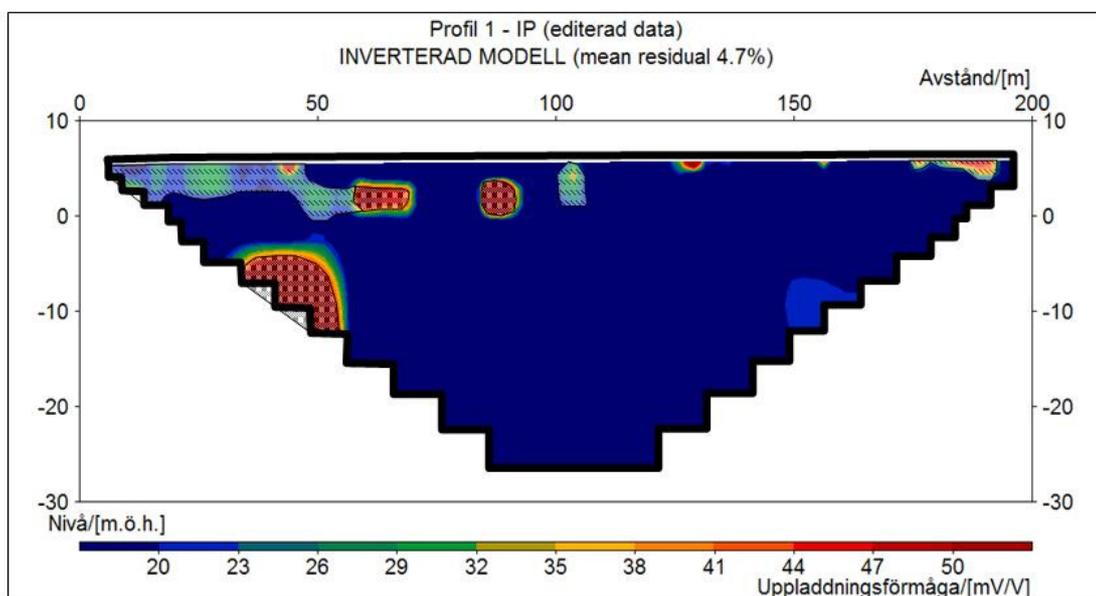


Figure 1 Inverted IP-section. The area with high chargeability to the left is interpreted as a possible zone of precipitation.

Conclusion

The conclusion is that IP-measurements could be useful for detecting the precipitation zone, but the high noise level makes the interpretation difficult.

References

Hägg, M & Johnsson, L (2007): *Övergången mellan förorenat grundvatten och havsvatten som potentiell retardationsprocess för förorenings-spridning – En studie av Kemira Kemis industritomt, Helsingborg*, Master thesis, Department of Physics and Department of Chemical Technology, Lund University.