

Mathematical modelling of VCH-contaminations in aquifers with incomplete data sets

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Frequently, volatile chlorinated hydrocarbons (VCH) emitted from industrial sites have caused pollutions in unprotected porous aquifers. Knowledge of sources, extension, concentration, dispersion and pollutant spectrum are important to plan remediation measures. Available data bases of local VCH-damages are in general incomplete (insufficient number of observation wells whereas single contaminants are analysed mostly completely). Therefore, an application of well established groundwater flow and contaminant transport models is impossible.

Distribution patterns of VCH and relations between their components depend on geological, hydrogeological, biological and other factors and vary in space and time. Conceptual models of aquifer contaminations can be developed by generalization. Adequate mathematical models for the state and development of VCH-pollutions in terms of mathematics have to be determined. Uni- and multivariate mathematical methods known from mathematical geology can be applied more or less successfully to model local groundwater contaminations with incomplete data sets:

1. univariate statistical distribution functions;
2. less suitable: statistical parameter estimators;
3. correlation, factor and principal component analyses;
4. first or second degree polynominal trend surface analyses;
5. less suitable: geostatistical prediction (kriging);
6. multivariate cluster and discriminant analyses;
7. univariate time series analysis.

The conceptual geo-ecological model, conditions of application, mathematical restrictions and requirements with respect to the data sets characterize each method mentioned above.