urban areas has resulted in an increased run-off and a lessened natural recharge into the groundwater systems. Utilizing urban run-off as a resource has been proposed and investigated to partially address water security concerns. On the other hand, lack of large storage spaces on the surface as well as high evaporation rates, has motivated scientists and engineers to consider controlled underground storage or managed aquifer recharge (MAR). Improved and unvarying water quality are additional advantages of underground storage. Urban run-off is known to contain many contaminants and therefore is required to undergo pre-treatment prior to any recharge injection. Regardless, some particles are likely to find their way into the aquifer.

Engineered nanoparticles (ENPs) are amongst these hard-to-filter particles and have recently been acknowledged as a group of new and emerging contaminants, in an imperative need to be regulated. Various types of ENPs, some of which are known to cause severe health issues in humans, animals and the environment in general, are mass-produced and used in many different products. Carbon nanotubes (CNTs), are a group of ENPs and have enthused scientist and engineers with their versatile characteristics, which facilitates various applications. Different types of CNTs have been used in drugs, cosmetics, sports gear, resistors, capacitors, polymers, bio medical inventions, and many other products. In 2010, 710 tons of CNTs and carbon nanofibres were produced, representing about 17% of the global production capacity. However, actual production is expected to reach more than 9300 tons in 2015 (about 80% of production capacity). With these rapid growth rates in production, the main question is: can we afford to overlook the risk and exposure assessment investigations which will be essential in setting appropriate handling, disposal, and remediation guidelines? Although it is evident that these particles are present in storm water, waste water, and urban run-off, which practically guarantees their introduction into aquifer systems, there is limited understanding of their transport and fate in groundwater.

in this paper, we present an exemplar model of the movement of carbon nanotubes in a natural groundwater system following a recharge injection. The objective is to raise the question of whether there is a need for more meticulous pre-treatment procedures at MAR sites in order to protect the water quality in aquifers. Various scenarios are simulated and examined to assess the potential exposure risk associated with the presence of CNTs in urban run-off injected into groundwater. The model is developed as a module in the MT3DMS modelling system specifically to simulate the transport of CNTs in groundwater flow systems.

32 Drainage waters affected by pyrite oxidation in an open pit coal mine in Can Region, NW Turkey

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The Yigitler Mine is abandoned open pit coal mine in Can Region, northwestern Turkey, about 45 km east of Canakkale city. The mine lies on either side of Katran River and drainage adits from both sides discharge acid mine drainage (AMD) into the river. The weathering product of sulfide oxidation is the formation of iron hydroxide, a red/orange-colored precipitate found in dozens of miles of streams affected by AMD. The river is severely affected by the AMD and it is one of the most polluted stretches of river in Canakkale city. The heavy precipitates are responsible for diminishing aquatic habitat and limiting stream uses in this reach. The qualities of the drainage waters from the Yigitler coal mine wastes were evaluated. The results show that pyrite is commonly the main source of acid production in mine wastes. Analysis of water from different areas of the waste and water were carried out a period of 3 years. During this period, pH and electrical conductivity (EC) values of AMD are ranged from 1.99 to 4.45 and 674 µS/cm to 7310 µS/cm, respectively. Concentration of sulfate (max 5370 mg/L) is very high in water samples at the Yigitler Mine site. In general, the water samples were characterized by the presence of elevated concentrations of Fe and Al. At the same time, high concentrations of elements, in particular Mn, Zn and Ni, were recorded. The amount of data on the mine and its effects on local residents and streams has provided the necessary insight to the problems. This study allows for the continuation into the next phases of the project through the compilation and evaluation of the data. The next phase "determination of AMD treatment alternatives" will provide the detailed information required for an evaluation of options for treatment of the AMD from the Yigitler coal mine.

782 - Evaluating representativeness of groundwater monitoring networks complying with European Directives using different statistical methods

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The implementation of the European Union Water Framework Directive (WFD, 2000/60/EC) and its daughter Directive on the Protection of Groundwater against Pollution (2006/118/EC), represents a tremendous challenge for the following years, since now the restoration and protection of groundwater status (quality and quantity) are engaged in a more comprehensive understanding of water resources. Therefore, comprehensive and representative water monitoring programs are essential pillars of policy implementations. Several statistical methods are applied here to evaluate the representativeness of the monitoring networks. The Representativeness Index was developed as a tool for assessing the homogeneity of the network. A certain degree of homogeneity of the network is a statistical prerequisite for the admissibility of applying different measures (arithmetic, weighted arithmetic, kriging mean, maximum likelihood) with respective confidence limits as aggregation methods. The methodology was applied to various types of aquifers located in Central part of Portugal. Results show that the groundwater monitoring networks are far from optimised. Changes to the monitoring programs are necessary and urgent, but naturally involve costs. Geostatistical tools can be used to optimize aquifer monitoring networks by highlighting those areas where the kriging standard error exceeds the standard deviation of the original data and identifying the wells providing relevant information that apparently cannot be obtained from the estimation from neighbouring wells and the wells appearing to be redundant, as their values can be estimated from neighbouring wells without large error