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Chemical stimulation in unconventional hydrocarbons extraction in the USA: a preliminary environmental risk assessment.

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While the exploitation of unconventional resources recently shows an extensive development, the stimulation techniques in use in this domain arouse growing public concerns. Often in the shadow of the disputed hydraulic fracturing process, the matrix acidizing is however a complementary or alternative procedure to enhance the reservoir connectivity. Although acidizing processes are widespread within the traditional hydrocarbons sources exploration, the matrix acidizing does not appear to be commonly used in unconventional hydrocarbons formations due to their low permeability. Nonetheless, this process has been recently applied to the Monterey formation, a shale oil play in California.
These stimulation fluids are composed by various chemicals, what represents a matter of concern for public as well as for authorities. As a consequence, a risk assessment implying an exposure and toxicity analysis is needed. Focusing on site surface accidents, e.g., leak of a chemical from a storage tank, we develop in this study concentration scenarios for different exposure pathways to estimate the potential environmental risk associated with the use of specific hazardous substances in the matrix acidizing process for unconventional hydrocarbon reservoirs in the USA.
Primary, information about the usage of different hazardous substances have been collected in order to extract the most frequently used chemicals. Afterwards, a probabilistic estimation of the environmental risk associated with the use of these chemicals is carried out by comparing the Predicted Environmental Concentrations (PEC) distribution with the Predicted No Effect Concentrations (PNEC) value. The latter is collected from a literature review, whereas the PEC is estimated as probability distribution concentrations in different environmental compartments (e.g., soil) built upon various predefined accident scenarios.
By applying a probabilistic methodology for the concentrations, the level at which the used chemicals could become risky for the environment can be determined. Additionally, these concentration levels are converted into corresponding quantities of hazardous substances in order to discuss implications in terms of safety measures and policy decisions.