Instantaneous release nuclide diffusion and migration simulation in fracture medium

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Most nuclear power plants are built on the bedrock foundations in China. The safety of nuclear power plant is an important matter. A magnitude 9.0 earthquake hit Japan's northeastern Honshu island on March 11, 2011. Fukushima nuclear power plant was disabled, releasing numerous uranium and radiocative ^{131}I dangerous contaminant into the environment. ^{131}I and ^{137}Ce have been detected in China.

The purpose of this work is to introduce nuclude diffusion and migration in fracture medium. Qian *et al* once studied contaminants migration in fracture medium [1,2]. Nuclide has its characteristics, such as attenuation, absorption, dilution, and so on. The experiment can be only carried out in laboratory. ^{131}I is used to simulate nuclide migration, its radiocative half-life is 8.3 days. According to the geological conditions of Zhejiang Sanmen Nuclear Plant, China, the lithology is tuff sandstone and andesite basalt on Unit 1 and Unit 2 reactor blocks. The fracture distributions are investigated on the field. Based on the statistical results, random fractures are generated using Monte Carlo method [3]. Li *et al* studied ^{85}Sr, ^{134}Se and ^{60}Co absorption equilibrium resperctively [4]. Iodine absorption coefficient is measured, then the diffusion and migration equation is established about include instantaneous release.

The research results show that: Instantaneous release of radionuclides in fracture medium is mainly diffusion and adsorption at the preliminary stage. When the adsorption reaches saturation, diffusion and migration of radionuclides play major roles. With the increase of radionuclide migration distance and the lapse of time, the decay will become more obvious and the impact will gradually disappear beyond a certain distance.

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[1] Qian *et al.*(2007) *J. Hydrol.* **339**: 206-219. [2] Qian *et al.* (2011) *Int. J. Rock Mech. Min. Sci.* **48**:132-140. [3] Zhou *et al.* (2004) *Int. J. Rock Mech. Min. Sci.* **41**:402. [4] Li *et al.* (2003) *Radiation protection bulletin.* **23(2)**: 27-31(in Chinese).

Carbon isotope of residual gas in the source and reservoir rocks in the Northeastern Sichuan Basin

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There are many large gas fields in the northeastern part of Sichuan Basin, but their origin and source are not clear due to limited information obtained from chemical compositions of accumulated gas. In this study, carbon isotopic signatures of residual hydrocarbon gas and CO_2 in different source rocks, reservoir rocks and solid bitumens have been measured and gas-source correlation have been done in this area.

Our results show that various source rocks in different geological period have different isotopic composition of residual gas. Methane in the Precambrian and Cambrian mudstones range from -34.1‰ to -39.4‰ with ethane -27.1‰ to -37.3‰, while other source rocks isotopic signatures are $\delta^{13}C_{C1}$=-30.2 ~ -32.6‰ for Ordovician , $\delta^{13}C_{C1}$=-30.9 ~ -31.8‰ for Silurian, $\delta^{13}C_{C1}$=-35.5‰ for Permian and $\delta^{13}C_{C1}$= -34.5‰ for Triassic, and ethane isotopic values in these source rocks lighter than -28‰ indicate that gases in various marine source rocks are derived from sapropelic organic matter except Permian source rock.

Residual gas in Precambrian solid bitumens are -30.6 ~ -34.9‰ for methane and -30.1‰ for ethane, while gas in the Lower Triassic and Upper Permian reservoir formations containing solid bitumens display methane $\delta^{13}C$ values between -32.5‰ and -36.1‰ lighter than methane values of gas in the reservoirs, ethane $\delta^{13}C$ values between -20.7‰ and -26‰ heaver than ethane values in natural gas, and $\delta^{13}C$ values of CO_2 between -8.6‰ and -13.6‰. It is conclusion that some natural gases maybe relate to Silurian source rocks, and thermochemical sulfate reduction (TSR) is not obvious in reservoirs.

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