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Environmental Radiological Baseline for Unconventional Oil and Gas Zones in Mexico

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The natural radiation level in a given site can be changed by NORM material generated by the oil, natural gas, copper, silver, uranium and lithium mining industries, among others. In Mexico there is no baseline of natural radiological levels but there is exploitation of energy resources by the industry and there is a possible extraction of unconventional hydrocarbons (UHC). This work deals with a radiological baseline study for four sites within the oil province of Tampico, which comprises 58% of the Mexican UHC reserves, the study is performed prior to the possible massive development of UHC extraction wells using the fracking technique. Three of the evaluated sites (A, B and C) are located in areas characterized by important hydrological reservoirs, grassland and seasonal agricultural crops for human consumption; the fourth site (D) is located in the Geological Basin of Burgos, relevant for its oil and natural gas extraction for the last 70 years and it is considered as one of the most important in the world. In each of the four sites, the environmental equivalent dose rate was determined for an area of 1 km², measured in five transects of 200 m each one. The results showed value bands, in mSv/year, of 0.99-2.18, 0.57-0.78, 0.61-0.74, and 0.13-0.88 for sites A, B, C and D, respectively. The bands of low values clearly show the non-impact of the zones by industrial activities. The radiological maps obtained were interpolated using the geospatial kriging method and are discussed in terms of vegetation, soil type, population and crops data layers for the study areas. The highest values of the equivalent dose rate are located in grassland areas and close to a population of approximately 181 inhabitants at 1.5 km distance. Additionally, groundwater flows were identified, where the presence of environmental 226Ra and decay products in water samples were assessed. These results are the first of this type for Mexico, which will serve for the energy sector as a reference for future comparisons and/or restrictive limits in the case of massive development of fracking or other extractive industries that can increase doses to the baseline of the site.

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