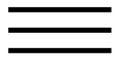


$^{226}\text{Ra}$  and  $^{228}\text{Ra}$  activities associated with agricultural drainage ponds and wetland ponds in the Kankakee Watershed, Illinois-Indiana, USA.

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$^{226}\text{Ra}$  and  $^{228}\text{Ra}$  activities associated with agricultural drainage ponds and wetland ponds in the Kankakee Watershed, Illinois-Indiana, USA

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### Abstract

Background radioactivity is elevated in many agricultural drainage ponds and also constructed wetland ponds in the Kankakee watershed. During 1995-1999, gross- $\hat{I}^{\pm}$  and  $-\hat{I}^2$  activities were measured up to 455 and 1650  $\hat{\text{mBq}} \hat{\text{L}}^{\hat{\text{m}}^3}$ , respectively.  $^{226}\text{Ra}$  and  $^{228}\text{Ra}$  averaged 139 and 192  $\hat{\text{mBq}} \hat{\text{L}}^{\hat{\text{m}}^3}$  in controlled drainage ponds compared to 53 and 58  $\hat{\text{mBq}} \hat{\text{L}}^{\hat{\text{m}}^3}$  for  $^{226}\text{Ra}$  and  $^{228}\text{Ra}$ , respectively, in native wetland ponds. Analyses of applied ammonium phosphate fertilizers near both native and controlled ponds indicate comparable  $^{226}\text{Ra}/^{228}\text{Ra}$  and  $^{228}\text{Ra}/^{232}\text{Th}$  activity ratios with only the surface waters in the controlled ponds. For example,  $^{226}\text{Ra}/^{228}\text{Ra}$  activity ratios in controlled

ponds ranged from 0.791 to 0.91 and group with a local fertilizer batch containing FL phosphate compounds with  $^{226}\text{Ra}/^{228}\text{Ra}$  activity ratios of 0.83–1.04. Local soils of the Kankakee watershed have  $^{226}\text{Ra}/^{228}\text{Ra}$  activity ratios of 0.54–0.70. Calculated Ra fluxes of waters, in drainage ditches associated with these controlled ponds, for  $^{226}\text{Ra}$  ranged from 0.77 to 9.00  $\text{mBq cm}^{-2} \text{d}^{-1}$  and for  $^{228}\text{Ra}$  ranged from 1.22 to 8.43  $\text{mBq cm}^{-2} \text{d}^{-1}$ . Ra activity gradients were measured beneath these controlled ponds both in agricultural landscapes and in constructed wetlands, all being associated with drainage ditches. Ra had infiltrated to the local water table but was below regulatory maximum contaminant limits. Still, measurable Ra activity was measured downgradient of even the constructed wetlands in the Kankakee watershed, suggesting that the attenuation of Ra was low. However, no Ra excess was observed in the riparian zone or the Kankakee River downgradient of the native wetland ponds.



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## Keywords

Radium; Isotope; Fertilizer; Watershed

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