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# Environmental isotopes and major hydrochemistry for tracing leachate contamination from a municipal landfill in Metro Manila, Philippines

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Investigations were conducted to assess the vulnerability to leachate contamination of freshwater sources in the vicinity of a major municipal landfill in Metro Manila, Philippines. The leachate exhibited distinct geochemistry from that of freshwater sources: distinctly high concentrations of sodium, chloride, potassium, and calcium, and elevated tritium activities which facilitated the tracing of leachate contamination of the surface water and the groundwater. The concentrations of major ions and tritium in the leachate affected river water correlated strongly and exhibited a concentration gradient that follows a negative exponential relationship with distance from the leachate source. Leachate from the collection pond was highly enriched in the heavy isotopes of hydrogen and oxygen, but to a greater extent in deuterium. Concentrations of leachate signature inorganic ions, Na, Ca, Mg, and Cl, in deep groundwater varied with rainfall but generally increased from the initiation of the study in 2003 to 2009. The isotopic composition of groundwater varied with season but not consistently throughout the sampling campaigns. These variations are attributed to the combined influence of methane production within the landfill and infiltration of leachate contaminated water.