

Fukushima's Tap and Groundwater a Decade after the Nuclear Accident with Radiocesium, Tritium, and Radon

Abstract

More than 13 years after the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident, concerns remain about drinking water contamination from artificial radionuclides and the ongoing discharge of tritiated water into the Pacific Ocean. However, natural radionuclides unrelated to FDNPP releases can also contribute to human radiation exposure. Here, we measured radionuclides in Fukushima tap and groundwater to assess exposure from ^{222}Rn (natural); ^{137}Cs (artificial); and ^3H (both artificial and natural). Ten years after the accident, all drinking water samples had ^{137}Cs levels below detection limits ($<0.02 \text{ Bq L}^{-1}$), while only groundwater had elevated ^{222}Rn ($<3 - 399 \text{ Bq L}^{-1}$). Trace amounts of ^3H ($0.07 - 0.55 \text{ Bq L}^{-1}$) were measured in both sources, with tap water generally exhibiting higher levels. ^3H levels in drinking water did not increase after several discharges of tritiated water into the Pacific Ocean. Estimated annual effective doses from tap water were $0.57 \mu\text{Sv}$ (^{137}Cs), $0.0058 \mu\text{Sv}$ (^3H), and $20 \mu\text{Sv}$ (^{222}Rn). For groundwater, doses were $0.57 \mu\text{Sv}$ (^{137}Cs), $0.0072 \mu\text{Sv}$ (^3H), and $1020 \mu\text{Sv}$ (^{222}Rn). The primary radiation exposure source is naturally occurring ^{222}Rn from rock formations. Boiling well water in a vented area reduced radon levels by 95%, significantly mitigating exposure.

KEYWORDS: ^{222}Rn , ^{137}Cs , ^3H , Fukushima, drinking water, effective dose