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## Hydrochemical and isotopic tracing of mixing dynamics for a stratified mine water quality under pumping conditions

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Water quality stratification in flooded underground workings following mine abandonment and cessation of pumping has been recognised only sporadically in the literature, and only recently are its implications for the planning and operation of pollution prevention / remediation measures being assessed. Since 1995, when pumps were withdrawn from deep mines in East Fife (Scotland) mine waters have been rebounding throughout the coalfield, and it has now become necessary in the next few years to pump and treat these waters to prevent their uncontrolled emergence at the surface. Results are presented here of hydrochemical and isotopic sampling of pumped mine water from a shaft in the Frances Colliery collected during two dynamic stepdrawdown tests to establish the hydraulic characteristics of the system. The use in particular of the environmental isotopes  $\delta^{18}$ O,  $\delta^2$ H,  $\delta^{34}$ S, <sup>3</sup>H, and <sup>14</sup>C alongside hydrochemical and hydraulic pump test data characterises the system dynamics, mixing patterns and water quality sources feeding into this mineshaft under pumped conditions.