

# Dual-Energy Gamma-Ray Transmission Technique for Measurement of the Density of Mine Water Treatment Sludge during Sedimentation and Consolidation

Lincar Pedroni<sup>1</sup>, Gregory Kennedy<sup>2</sup>, Michel Aubertin<sup>1</sup>

<sup>1</sup>Department of Civil, Geological and Mining Engineering, Ecole Polytechnique, Montreal, Canada

<sup>2</sup>Department of Engineering Physics, Ecole Polytechnique, Montreal, Canada

## Abstract

The technique of gamma-ray transmission has been used to measure the variation in density of a treated acidic mine water sludge as it settles during sedimentation and consolidation. A source and Sodium-Iodide detector are arranged to vertically scan a sludge-filled 180cm high Plexiglas column in a few minutes. The measured data are used to plot density profiles over time which can be used to help predict the long-term behaviour of sludge in mine tailings ponds.

This paper presents recent tests which have been performed using a single source of <sup>153</sup>Sm and considering two energies (41-42keV and 103keV), in order to simultaneously determine the solids density and water content during sedimentation and consolidation of mine sludge with a low heavy metal content. A previous system using two sources, <sup>153</sup>Sm (103 keV) and <sup>198</sup>Au (412 keV), was found useful for determining the water content of sludge with high heavy metal content but failed to distinguish between water and solids in sludge with low heavy metal content. The dual-energy technique has achieved an accuracy of 0.04 g/cm<sup>3</sup> for both solids density and water content in the sludge. However, the chemical composition of some sludge can limit the use of this technique depending on the gamma-ray energies used.