

VOLATILIZATION OF HEAVY METALS AND RADIONUCLIDES FROM SOIL  
HEATED IN AN INDUCTION "COLD" CRUCIBLE MELTER

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#### ABSTRACT

The behavior of heavy metals and radionuclides during high-temperature treatment is very important for the design and operational capabilities of the off-gas treatment system, as well as for a better understanding of the nature and forms of the secondary waste. In Russia, a process for high-temperature melting in an induction heated "cold" crucible system is being studied for vitrification of Low Level Waste (LLW) flyash and SYNROC production with simulated high level waste (HLW).

This work was done as part of a Department of Energy (DOE) funded research project for thermal treatment of mixed low level waste (LLW). Soil spiked with heavy metals (Cd, Pb) and radionuclides (Cs-137, U-239, Pu-239) was used as a waste surrogate. The soil was melted in an experimental lab-scale system that consisted of a high-frequency generator (1.76 MHz, 60 kW), a "cold" crucible melter (300 mm high and 90 mm in diameter), a shield box, and an off-gas system. The process temperature was 1350-1400°C. Graphite and silicon carbide were used as "sacrificial" conductive materials to start heating and initial melting of the soil batch. The off-gas system was designed in such a manner that after each experiment, it can be disconnected to collect and analyze all deposits to determine the mass balance. The off-gases were also sampled during an experiment to analyze for hydrogen, NO<sub>x</sub>, carbon dioxide, carbon monoxide and chlorine formation.

This paper describes distribution and mass balance of metals and radionuclides in various parts of the off-gas system. The leach rate of the solidified blocks identified by the PCT method is also reported.

#### INTRODUCTION

In selecting a thermal treatment for mixed wastes, distribution of radionuclides and toxic metals produced by different melter designs has to be evaluated to evaluate the capabilities of the technology. One of the alternative melter designs is a high-frequency induction cold