

# A PLUTONIUM-238 RAPID EMERGENCY RESPONSE BIOASSAY AT CLINICALLY RELEVANT LEVELS FOR RADIOLOGICAL EMERGENCY

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## ABSTRACT

Rapid Pu-238 assessment is necessary in a radiological emergency to identify individual and population exposures and doses and to guide effective medical management decisions. We have developed a rapid bioassay method to determine Pu-238 in human urine using microwave digestion at 180°C and 375 PSI for 4 minutes, followed by normal diglycolamide (DGA) extraction and micro coprecipitation. The method identifies Pu-238 at clinically relevant levels using alpha spectroscopy. Several methods and a variety of resins were investigated during the development process and, where appropriate, we prioritized waste reduction and analysis cost.

We performed method validation following the criteria for quantitative analytical methods established by the CDC Division of Laboratory Sciences. We evaluated linearity, repeatability, ruggedness, carryover, range, accuracy, recovery, limit of detection (LOD), analyte stability, and correlation among the 128 detectors in the instrument. This method exhibits linear signal response between concentrations of 2.92 - 700 Bq/L. The mean recoveries of Pu-238 and Pu-242 tracer are (93.8±5.4)% and (91.0±3.9)% respectively. The correlation among the 128 detectors in the instrument is (0.997±0.003) and the LOD for Pu-238 is 2.92 Bq/L. The method parameters meet the intended purpose: to assess patient contamination with Pu-238 after a radiological incident to enable dose calculation related to the NCRP Clinical Decision Guide.

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