DETERMINATION OF ^{237}NP AND ^{239}PU IN URINE USING SECTOR FIELD INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY (SF-ICP-MS)

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Quantification of ^{237}Np and ^{239}Pu in urine at medically relevant levels is important for biomonitoring and radiological emergency response when assessment of individual's or population's accidental, environmental, or terrorism-related internal contamination is necessary. CDC does not currently have a convenient, accurate and precise methods to rapidly and simultaneously determine medically relevant levels of ^{237}Np and ^{239}Pu in people. Here we report a new analytical method to measure ^{237}Np and ^{239}Pu as developed and validated by means of the selective retention of Np and Pu from urine directly on TEVA resin, followed by their elution and introduction into a membrane desolvating introduction system coupled to a Sector Field Inductively Coupled Plasma Mass Spectrometer (SF-ICP-MS) system for identification and quantification. The method produced Np/Pu recoveries over a range of 90% to 111%, Limits Of Detection (LODs) of 0.62 pg/L (1.62E-5 Bq/L) for ^{237}Np and 0.89 pg/L (2.05E-3 Bq/L) for ^{239}Pu (much lower than our target of 1/3 of the Child/Pregnant Woman NCRP 161 Clinical Decision Guides for ^{237}Np and ^{239}Pu at 5 days post-exposure). CDC estimates that rapid analytical results will be obtained for 100 patient samples within 24 hours (per instrument). Results obtained using this method agree within experimental uncertainty of values measured using a method that combines an Extraction Chromatography system in line with a Quadrupole Inductively Coupled Plasma Mass Spectrometry (EC-QICP-MS), and with Oak Ridge National Laboratory (ORNL) Reference Materials (RM) target values. This procedure is appropriate for rapid identification and quantification of ^{237}Np and ^{239}Pu in urine for a public health emergency response involving accidental or terrorism-related exposures, or for evaluating chronic environmental or other exposures, and will undergo further refinements to become a rapid CLIA compliant analytical method for use at CDC.