DETECTION OF ^{63}Ni AND ^{59}Ni BY ACCELERATOR MASS SPECTROMETRY USING CHARACTERISTIC PROJECTILE X-RAYS

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The long-lived isotopes of nickel have current and potential use in a number of applications including cosmic ray studies, biomedical tracing, characterization of low-level radioactive wastes, and neutron dosimetry. Methods are being developed at LLNL for the routine detection of these isotopes by AMS. One intended application is in Hiroshima dosimetry. The reaction ^{63}Cu(n,p)^{63}Ni has been identified as one of a small number of reactions which might be used for the direct determination of the fast neutron fluence emitted by the Hiroshima bomb (Marchetti and Straume 1996, *Appl. Radiat. Isotop.* 47, 97). AMS measurement of ^{63}Ni ($t_{½}$ = 100 yr) requires the chemical removal of ^{63}Cu, which is a stable isobar of ^{63}Ni. Following the electrochemical separation of Ni from gram-sized copper samples (reported by Marchetti, *et al.*, these proceedings), the Cu concentration is further lowered to $< 2 \times 10^{-8}$ (Cu/Ni) using the reaction of Ni with carbon monoxide to form the gas $Ni(CO)_4$. The $Ni(CO)_4$ is thermally decomposed directly in sample holders for measurement by AMS. After analysis in the AMS spectrometer, the ions are identified using characteristic projectile X-rays, allowing further rejection of remaining ^{63}Cu. In a demonstration experiment, ^{63}Ni was measured in Cu wires (2–20 g) which had been exposed to neutrons from a ^{252}Cf source. We successfully measured ^{63}Ni at levels necessary for the measurement of Cu samples exposed near the Hiroshima hypocenter. For the demonstration samples, the Cu content was chemically reduced by a factor of 10^{12} with quantitative retention of ^{63}Ni. Detection sensitivity (3σ) was ~20 fg ^{63}Ni in 1 mg Ni carrier (^{63}Ni/Ni $\approx 2 \times 10^{-11}$). Significant improvements in sensitivity are expected with planned incremental changes in the methods. Preliminary results indicate that a similar sensitivity is achievable for ^{59}Ni ($t_{½} = 10^5$ yr). We will also report on initial work on the application of this isotope as a biomedical tracer in living systems.

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NORMALIZATION OF BERYLLIUM-10 IN MARINE SEDIMENTS AND ASSOCIATED PROBLEMS

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The cosmogenic radionuclide ^{10}Be is predominately produced in the upper atmosphere and is quickly precipitated onto the surface of the Earth. Its production rate in the atmosphere is a function of the intensity of the geomagnetic field, solar activity, and the primary cosmic-ray flux. Thus, ^{10}Be can be a valuable source of information for the previously stated geophysical and astrophysical phenomena. Nevertheless, the deposition and consequent transport of ^{10}Be through the environment can obscure the original influences on its production. Presumably, such problems incurred upon transport can be limited by studying polar or mountain-ice archives because of direct precipitation of ^{10}Be onto the ice. However, ^{10}Be concentrations in the ice are influenced by glacial rheology and local precipitation. Potentially, marine sediments record a ^{10}Be production-rate signal that is more