

Ni-63 in Chernobyl „ruthenium hot particles” and in forest soil samples

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for HP and bulk samples, respectively. The ^{63}Ni for bulk samples was also correlated with ^{137}Cs , and the average ratio $^{63}\text{Ni}/^{137}\text{Cs}$ (calculated for 1986) was in range of about 10^{-3} .

The Chernobyl fallout consisted of a wide spectrum of particle diameters: from tiny, less than one micrometer of diameter aerosol which were transported for a long distances up to relatively large particles deposited nearby the accident place. Radionuclide composition of particles was a function of their origin or formation process. Small particles were mostly condensates of vapors, whereas larger were likely just blow out of reactor during initial explosion or later, during decomposition of materials in fire. Since they were much more active than surrounding they were called “hot particles” (HP). Two main kinds of hot particles were recognized and named: “fuel-like”, which were just pieces of nuclear fuel and “mono-elemental” (or “condensation”), which showed dominant activity of only one element. The most typical mono-elemental one were so called “ruthenium HP”, which were recognized in 1986 as having solely ^{103}Ru and ^{106}Ru activity. Later, other radionuclides were found there, among them ^{60}Co and ^{125}Sb . There was a controversy about forming of such particles: some authors identified them with “white inclusions” present in spent nuclear fuel whereas some others suggested condensation mechanism which might form them from vapors. The matrix of ruthenium HP showed traces of nickel, and thus the idea of the ^{63}Ni presence there came to us. A relatively massive fallout of small HP from Chernobyl cloud was found in the northeastern Poland. We had a collection of isolated in 1986 large “ruthenium HP”, which were examined previously twice (1986 and 1991) for all the gamma emitters. Thirteen of such isolated HP were taken for analyses. The second set of samples consist of nine forest soil/litter/hums bulk samples collected in 2007 in a distance of about 5 km North-West or South from Chernobyl power plant (two locations). The bulk samples were expected to have among other radionuclides also a massive fallout of HP. All the samples were analyzed for ^{63}Ni using radiochemical procedure and liquid scintillation spectrometry. The radiochemical procedure applied to HP were relatively simple: consist of and full mineralization, separation from ^{60}Co using Dowex-1 column and DMG precipitation. The procedure for bulk samples needed additional purification steps to remove any traces of dominant activity of ^{137}Cs and ^{90}Sr . For both: HP and bulk samples activities of ^{60}Co (determined by gamma spectrometry) and ^{63}Ni were correlated and the activities ratio of $^{60}\text{Co}/^{63}\text{Ni}$ were comparable. They were equal (mean \pm standard deviation, calculated for May, 1986) to 0.231 ± 0.199 and 0.204 ± 0.263 ,