International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle: Exploration, Mining, Production, Supply and Demand, Economics and Environmental Issues - IAEA CN-216

Contribution ID: **85** Type: **Poster**

Measurement of 226Ra and 228Ra in Brazilian and Israeli Phosphates

Wednesday 25 June 2014 17:10 (1 minute)

Since the 1970's, IAEA recognizes that phosphoric acid poses as an alternate source of uranium. But given the status of both phosphate and uranium markets the potential of recovering uranium from phosphoric acid still marginal. New technologies for the recovery of uranium from phosphoric acid, national and global interests and environment barriers could shape this market in the medium and long-term scenarios.

On the other hand, the use of phosphates is the major source of phosphorus in agriculture and livestock. Beyond phosphorus and calcium, phosphate is also source of some hazardous elements, such: arsenic, cadmium, thorium and uranium, including a variety of radioisotopes as well. This radioactivity is sure to be released in the environment, contributing to the background. The risk is not recognized for some of the players in this market, mainly workers who apply phosphate fertilizers in the farmland, in some cases manipulating phosphates with their bare hands, and without any respiratory protection equipment (RPE) as well.

This paper deals with the radioactivity from 226Ra and 228Ra in four phosphates often used in Brazilian agriculture. Three Brazilian and an Israeli phosphate were analysed and compared with international criteria. The specific activities of 226Ra (from the uranium decay series) and 228Ra (from the thorium decay series) were taken into consideration to ensure an adequate risk assessment.

Specific activities were determined by high-resolution gamma spectroscopy with germanium detector and Genie® software from Canberra in the Centre of Nuclear Technology Development (CDTN/CNEN). The concentration of 226Ra was measured using the 186.2 keV energy peak, the concentration of 228Ra through 228Ac. The system was calibrated using a set of standard materials from IAEA. The measured samples were crushed and sieved to a grain (98% at least) size as small as 75 µm. Stable mass was achieved grinding, drying at 105℃ and mixing each material.

Table 1: 226Ra and 228Ra in some phosphates

Phosphate 226Ra [Bq.g-1] 228Ra [Bq.g-1]

BRP, 34% P2O5, Brazil 0.14 ± 0.04 0.40 ± 0.10
PMP, 28% P2O5, Brazil 0.16 ± 0.04 0.09 ± 0.03
BOI, 46% P2O5, Brazil 0.06 ± 0.02 0.12 ± 0.03
IPR, 31% P2O5, Israel 1.60 ± 0.28 0.08 ± 0.03

BRP = Brazilian Rock phosphate, PMP = Brazilian industrial phosphate, BOI = Industrial Feed Phosphate, IPR = Phosphate rock from Israel. n=3

For exposure arising from work involving NORM, consensus seems to be emerging around activity concentrations of 1 Bq.g-1 for uranium and thorium series radionuclides as criteria for determining whether exposure to NORM should be excluded from regulatory consideration. For materials with activity concentrations above these levels, as the Israeli phosphate studied, the regulatory body needs to decide on a case-by-case basis if it should be included in the system of control.

Hence, people working at factories that mine and process phosphate or handling phosphate fertilizers in farmland activities, are expect to be exposed to higher doses of gamma radiation than rest of the population.

Author: Dr CANELLA AVELAR, Artur (Universidade Federal de Minas Gerais)

Co-authors: Dr MENEZES, Maria A.B.C. (Centre of Nuclear Technology Development CDTN/CNEN); Prof. FERREIRA, Walter Motta (School of Veterinary, UFMG)

Presenter: Dr CANELLA AVELAR, Artur (Universidade Federal de Minas Gerais)

Session Classification: Poster Session

Track Classification: Health, safety and environment