

# Development of a methodology to minimizing $^{241}\text{Am}$ waste from radioactive lightning rod

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## Abstract

In 1989, the Brazilian National Nuclear Energy Commission, CNEN cancelled the authorization to produce and to install lightning rods that employed radioisotopes sources, which since then have been collected and treated as radioactive waste [1]. The main radioisotopes employed as a radioactive source onto the lightning rods were the  $^{241}\text{Am}$  and  $^{226}\text{Ra}$ , being the  $^{241}\text{Am}$  the most used due to its lower production cost. These captors when constantly exposed to rain and winds can release the radioactive material and then contaminate the device, generating a greater volume of waste [2].

The focus of this study is to develop a methodology to minimize the final volume of waste by removing the source which is followed by a chemical treatment to clean the lightning rods [3].

Ultrasound techniques associated with suitable solvents as water, acids and special chelates were applied. Studies were performed by varying the reagents concentration and contact time. The Gamma spectrometry was used to analyze the material after each decontamination step. Acids and chelating solutions showed to be most efficient.

The decontamination was made by immersion in solutions  $0.1 \text{ mol L}^{-1}$  of ammonium carbonate, sodium salicylate and hydrochloric acid respectively for 30 minutes. A dedicated software program (**Genie 2000** from Canberra) analyzed each experiment. Spectra were obtained before and after each treatment. The decrease of the peak area was compared with the result obtained by treating with tri-distilled water using ultrasonic bath (Varian Aerograph 60 Hz), after 10 minutes.

The system was calibrated using a  $190.5 \text{ kBq } ^{241}\text{Am}$  source. The photo peak efficiency determined was  $72.73 \pm 0.25$  and the peak area  $2.18 \times 10^5 \pm 488.73$  (acquisition time = 300s).

In agreement with Standards of Radiological Protection, the results show that it is possible to dispose the lightning rod after the source removal followed by a suitable treatment minimizing the environmental impact by reducing the volume of waste.

## References

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