



Radiological Risk Assessment in Irregularly Installed and Discharged Lightning Rods through the Design of Exposure Scenarios

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1. Introduction

The need to implement effective protection systems against the effects of atmospheric discharges awakened scientists to the idea of using radioactive material to increase the effectiveness of lightning rods. Radioactive lightning rods have the function of increasing the current when the sensor containing radioactive material is subjected to the electric field that produces the lightning.

The commercialization of lightning rods containing radioactive sources in Brazil began in 1970 and reached, according to official estimates 75,000 units containing Americium-241 with a unit activity of around 1.5 mCi. [2]

However, the effectiveness of the radioactive arrester in guaranteeing better protection against atmospheric discharges compared to the conventional arrester was disproved in the 1980s.

Motivated by the basic principle of radiological protection of justification, the CNEN (National Nuclear Energy Commission) suspended the authorization of the manufacture, sale and installation of lightning rods containing radioactive materials in 1989 and established procedures for removal, transport and transfer to collection centers of radioactive waste. However, CNEN did not force the removal of those already installed and left the responsibility for replacing the radioactive lightning rods to the authorities linked to municipal inspection. This has in some cases led to the exposure of people to radioactive materials especially those that have been irregularly disposed of. [1]

2. Methods

Considering that there may be exposure of people in accident scenarios involving these devices, a study on the risks involved in two of these scenarios is presented. Through physical and mathematical modelling of the scenarios, the risk of exposure to radioactive lightning rods still installed, and the risk of exposure arising from irregular disposal are evaluated.

To carry out the risk analysis a scenario of exposure of children will be established in a schoolyard in which a radioactive lightning rod is installed and from which radioactive material is removed by the action of wind erosion, wind transport and inhalation or exposure to material deposited in the soil. Another analyzed scenario arises from the simulation of the disposal of radioactive lightning rods in a junkyard as a material for recycling. These scenarios are built through a sequence of events and processes, natural or anthropic presented through process flowcharts. These events and processes for the installed lightning rod are wind erosion of the source cover the extraction of Americium-241 from the source, the atmospheric dispersion of radioactive material in the form of an aerosol, precipitation and deposition in the soil, washing by rain, inhalation, ingestion, skin contamination. The events and processes for the irregularly disposed of the lightning rod are the transport of the device to a metal recycling facility direct exposure by manipulation of the device or source removed from the device, erosion of the source cover, natural extraction of Americium- 241 of the source, atmospheric dispersion of radioactive material in aerosol form, precipitation and deposition in the soil, rain washing, inhalation, ingestion and skin contamination.

3. Results and discussion

The result of the study is the expected doses arising from the exposure scenarios.

4. Conclusion

The expected conclusions for this study should present a low dose of americium-241 without compromising the affected environment.

References

[1] Gerson A. Santarine G. A; Matos C.R.A. “artigo”, *Pára-Raios Radioativos: Gestão E Espacialidade No Município De Rio Claro-Sp - Riscos De Contaminação Ambiental*, (2006).

[2] Marumo J.T, “tese doutorado”,(2006).