2021 International Nuclear Atlantic Conference – INAC 2021
Virtual meeting, Brazil, November 29 – December 2, 2021

ISBN: 978-65-594-1256-3

Long-term Institutional stability for radioactive waste governance

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1. Introduction

The isolation of the radioactive waste that requires long-term storage before disposal depends on the institutions in charge of maintaining security and safety will endure for the required time to perform their duties. However, past experiences indicate that are multiple causes or loss of institutional control in the long term. It is arduous for institutions to remain stable for several centuries and this problem can affect the correct management of radioactive waste.

In Brazil, this is the case in the storage of spent fuel from research reactors and disused sealed radioactive sources, that projects for their disposal are expected to occur some decades in the future.
Although the examples of loss of institutional stability in the world are few, they may raise the question that the loss of institutional stability should deserve attention as plausible scenarios in the safety analyses of waste management projects. Therefore, the issue concerning the loss of stability is not a recent question. Issues of ethical dilemmas transcend time and will affect different generations in the future. This is the case of radioactive waste management.

Three of these examples and their impact on radiological safety are the cases of the former republics of the USSR, where sources of category one or two, of the D system established by the IAEA, were left unattended and caused accidents with fatal victims as a result of exposure to the radiation.

In 1994, a serious radiological accident in Estonia caused the death of one person and injury to many others. The origin of the accident happened when three brothers entered the radioactive waste storage facility at Tammiku, without any authorization, and stole a radioactive source containing 137Cs, a shiny metal cylinder without any warning sign of danger, to sell as metal scrap.

In 1997, radioactive cesium sources that are believed belonged to a specialized army troop of the former USSR were found in a training camp in the Republic of Georgia, after having caused severe burns in eleven Georgian soldiers who were unaware of their existence. It seems reasonable to presume that the demise of the former government staff and of the chain of command left the sources orphaned.

In early December 2001, two 90Sr sources with an activity of 1295 TBq were found in a forest by three individuals who were collecting firewood. These unknown objects were used by the three men as heaters in the cold night they spent in the woods. Those radioactive sources were former heat sources of radioisotope thermoelectric generators in a radio relay system of hydroelectric power projects that ended because of the collapse of the USSR. Because of the high activity, the sources caused serious skin injuries in two of them. The Georgian authorities could not determine the circumstances under which the sources became orphaned.

It is fair to assume that all these three accidents have the same main reason: loss of institutional stability. Because of the dissolution of the USSR, their regulatory system for radiation protection and waste

management needed to be adapted to the new States and, as long as this process was not completed, many accidents have occurred since then.

2. Methodology

Literature scrutinization about what has been published by social scientists and institutional analysts, regarding the stability of institutions, and what are the indicators of stability and the causes of loss of their management capability. Research will be developed through a hypothetical-deductive method associated with exploratory-descriptive methodology, regarding it is a research that debates aspects of human behavior.

3. Results and Discussion

The main purpose of this paper is to present the status of the research that aims to understand the relationship between institutional stability and radiological safety of radioactive waste in the long term. The motivation for this paper is to better understand the behavior of institutions in the long term and what can be done nowadays so that the safety of radioactive waste is sufficiently assured in the future. Therefore, the present research is in development and does not present preliminary results. Identificados fatos que estão relacionados, a História mostra que isso aconteceu. Exemplos históricos de perda de estabilidade institucional com impacto na segurança da gestão dos rejeitos.

4. Conclusions

Analyzing the institutional behavior, it is reasonable to assume that the human management of sites where radioactive waste will be stored for hundreds of years in the future is an insurmountable challenge. According to these observations about the temporality of institutions, the following question arises: It is also necessary to get to the cause of what can lead to institutional failure? Is it possible for this to occur in the future? Finally, the present paper intends to analyze the institutions and the difficulties in maintaining them stable for several centuries required by radioactive waste. Furthermore, it is necessary to what can be done to prevent it from occur, or at least mitigate the worst scenarios.

Acknowledgements

Our acknowledgments to the organization of the International Nuclear Atlantic Conference 2021, as well as all the participants of the event, and the group from the Radioactive Waste Management Service of the Nuclear and Energy Research Institute of the National Nuclear Energy Commission.

References

EUA, Comissão Regulatória Nuclear. **What Does the U.S. Do with Nuclear Waste?** Revista Científica Americana, 2008.
Disponível em:
<https://www.scientificamerican.com/article/what-does-the-us-do-with-nuclear-waste/>

LOPEZ, Amanda. **"Radioactive Waste Management in St. Louis".** Undergraduate Research Symposium. University of Missouri, St Louis. USA, 2021.

European Comission. **First circular economy action plan**. União Europeia, 2018. Disponível em: https://ec.europa.eu/environment/topics/circular-economy/first-circular-economy-action-plan_en

VAZ, Jorge j. Landeiro. **"Questões epistemológicas fundamentais na investigação em gestão: o método hipotético dedutivo."** Estudos de Gestão, Vol. 4, n.2. 1998. Disponível em: https://www.repository.utl.pt/bitstream/10400.5/9898/1/eg-jjlv-1998.pdf

MAKSYM, Kutsevych et al. **"European Journal of Sustainable Development".** European Center of Sustainable Development.Vl, 9, n2, p163-171. 2020.
Disponível em: https://ecsdev.org/ojs/index.php/ejsd/article/view/1017/1007

GUDKOVA, Oleksandra. **Atoms for Peace and Development":** Sixty Years of Entry into Force of the IAEA Statute. Escritório de Informação Pública e Comunicação da IAEA. Disponível em: <https://www.iaea.org/newscenter/news/atoms-for-peace-and-development-sixty-years-of-entry-into-force-of-the-iaea-statute>

ANDERSON, Janna. "**Futures Studies Timeline".** Elon University, USA, 2019. Disponível em: https://www.elon.edu/u/imagining/wp-content/uploads/sites/964/2019/07/Futures-Studies-Timeline.pdf

ALESINA, Alberto, et al. **"Political Instability and Economic Growth"**. Journal of Economic Growth, vol 1, p189-211. Kluwer Academic Publishers, USA. 1996.

TONN, Bruce E. **"Institutional designs for long-term stewardship of nuclear and hazardous waste sites."** Technological Forecasting & Social Change, vol 68, p 255 – 273. USA, 2001.

EASTERLY, W., REBELO, S. **"Fiscal Policy and Economic Growth: An Empirical Investigation?"** Journal

of Monetary Economics, 32. USA, 1993.