

**Documentary about the contributions of Jose de Julio Rozental for nuclear energy
and radiological safety for the country**

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Abstract

The documentary delivers the contributions of the nuclear physicist Jose de Julio Rozental to nuclear energy in Brazil. It includes testimonies of scientists and family members and contains images of Rozental's interviews and narrations in off extracted from his articles. The first part presents the efforts of Rozental as member of the pioneer's engineering group to build the third Brazilian and the first nationalized nuclear research reactor in the Nuclear Engineering Institute (IEN), Rio de Janeiro. Also in IEN, Rozental created the first Brazilian research group in radioisotopes applications on industry and hydrology. As Director of the Brazilian Nuclear Energy Commission for seventeen years, he introduced the regulatory control system of the nuclear facilities and radiation sources in the country which still remains. During the radiological accident in Goiania in 1987, he coordinated the recovery operations looking forward to rescue population's self-esteem. He stayed in Goiania until 1993 to face the difficulties with the radioactive waste repository project. The documentary highlights the lessons learned due to the accident, extract form the articles and conferences given by him in many countries after his retirement in 1993. In 1997, he came back to Brazil to receive Goiania's citizen title. He died in Israel in 2010.

Methodology

The 15 minutes DVD edited in full HD format includes testimonies of Brazilian scientists, colleagues and family members. It contains images of Rozental's interviews and narrations in off extracted from his articles. The documentary highlights the professional life and the lessons learned due to the Goiania radiological accident, published in the articles written by Rozental or discussed during the conferences given by him in many countries after his retirement in 1993. The documentary presented in the PSCTC2014 is a short version of the 66 minutes complete documentary presented in April, 15th, 2013 in International Association of Radiological Protection Regional Conference held in the Hotel Royal Tulip, Rio de Janeiro, in order to celebrate the "Day of the Radiological Protection", date created by Rozental's proposal in 2005. According him, it was necessary to improve understanding of the civil society about the subject.

The "Argonauta" Reactor

The first contribution of Rozental to the nuclear energy was to participate (1963-1965) in the construction of the Argonauta reactor, the third Brazilian and the first nationalized nuclear research reactor, located in the Nuclear Engineering Institute (IEN), in Rio de Janeiro. After graduation in Physics, he got a fellowship for the Master degree in Nuclear Engineering at the University of Brazil, actual Rio de Janeiro Federal University. The course director, Luis Aghina, invited him to participate in the Argonauta project. The called "pioneer's engineering group" was formed by students of the "Atoms for Peace Project" in U.S, who are engineers and technicians from Brazilian Commission of Nuclear Energy (CNEN) and also from CBV Mechanics and Microlab, created based on Argonne National Laboratory Project (U.S.A.). The Argonauta reactor fuel elements were developed by IPEN (Energetic and Nuclear Research Institute), located in São Paulo. It was imported only enriched uranium of the fuel, the lead to moderate neutrons and a few electronic components. On the documentary, Luis Aghina testimonies Rozental's enthusiasm during the period worked on the Argonauta project and how they became friends. Besides the technical position, Rozental was very efficient in the economic planning acquisition of the reactor components.

The first nuclear research reactor with almost all national components built in Brazil was an achievement for the country, a great victory for the pioneer's group and it was very special moment for Rozental. He has been a Jewish boy born in the countryside of São Paulo in 1932, son of a modest immigrant family from Romania. Rozental have worked as a shoe shiner in his childhood.

The political situation in Brazil in 1963 was the same as the most countries in the years of cold war. The South American countries were under pressure to take a side between the two political superpower of the world. Knowing that the nuclear knowledge was an important piece in the world politics, Brazil built the reactor in order to raise his technical experience in a field that was important for the country independence. And yet, the fact that was built with help of former scholarship students of the Atoms for Peace of the U.S.A. demonstrates the non-military perspective of the project. In 1964, the political scenery in Brazil changed. Despite the original project facility was inaugurated by President João Goulart, he was not in Presidency anymore. But that fact didn't affect the project. On February 20th of 1965, the reactor reached his first criticality. On May 7th the Argonauta reactor was official inaugurated by the new President of Brazil, General Humberto de Alencar Castello Branco.

The Industrial Applications of Nuclear Energy

In 1967, the Nuclear Engineering Institute began the first research on industrial and hydrology applications of nuclear techniques, for example, gamma radiography and neutron radiography. The group was formed by Rozental, Luis Aghina, Hugo Chavez Moreira, Lydia dos Santos Rocha, José de Anchieta Wanderley da Nobrega, Fernando da Veiga Watson, Frida Eidelm, Jose Ribeiro da Costa, Eugeneo Bodea, Luiz Fernando Vallim Shneider and José Fairbanks Evangelista (Figure 1).

In 1970, Rozental went to United Kingdom, Denmark, Sweden and France to visit several industrial installations and research institutes. According to his travel report, "in now days, the industrial use of radiations and radioactive materials are growing in rich countries and also in the countries that are in development."

Radioisotopes are used in the industry to measure and control fabrication process, and to inspect materials, components and final products in order to determine the causes of

oil and gas processing difficulties, especially in large scale experiments involving production plants. The neutron radiography, as well as gamma radiography, is used for materials and structures testing. The inspected object, in this case, is exposed to the radiation source that emits neutrons and the image is captured by a photographic film. The density measured on the film is due to the interaction between neutrons and the object atoms. While the X or gamma radiations are attenuated by heavy elements, neutrons are attenuated by soft elements. Rozental also performed inspections of the Varig airplanes turbines using industrial radiography. However, all radioisotopes applications must have an adequate radiological program to be performed.



Figure 1

The Brazilian nuclear regulatory control

In 1970, Rozental became director of the Brazilian Nuclear Energy Commission (in Portuguese, CNEN), responsible for regulatory control of nuclear facilities. The first discussions to elaborate the CNEN's legislation occurred in 1971 with Rozental, Fernando Bianchini and the lawyer's group formed by Paulo Noronha and Ayrton de Paiva. The first resolution established the radiation protection for workers and individuals of the public against ionizing radiation. In 1974, another resolution demanded the presence of radiation protection supervisor as the responsible for the facility control regarding to the radiation sources. Also, it was implanted the control of the importation and exportation of radioactive sources originally through an authorized form granted by CNEN. Later, this procedure was replaced by an online System, integrated with the Exterior Commerce System (SISCOMEX) for controlling the entrance and the exit of radioactive materials and equipment that provides radiation, allowing that only authorized installations and registered professionals could operate radioactive sources in the country.

The radiographic tests welding seam on oil ducts and refineries are obligatory at the time of construction and periodically to verify their integrity. Most of the ducts reach urban and rural areas. Since 1986, the planning of operations involving industrial radiography in urban areas should be submitted to CNEN in order to evaluate the conditions of public and workers radiological protection for granting an operational license for a determined period and its renewal demands local inspections. The training and qualification of the industrial radiography operators reduced the radiological accidents occurrences at that time.

The evolution of Medicine reinforce the applications, methods and concepts of Physics becoming indispensable the constant work of specialized professionals. A fundamental work performing by these professionals relate to applications of energy, concepts and methods in order to reach diagnostic and improve therapy. The professionals of Medical Physics played an important role assisting medical and biomedical research in order to reach the optimization of radiological protection. So, it was established an important relationship between technical quality, professionals and environment protection. From these requirements, emerged a natural interaction between the professionals of several medicine specialties. This interaction contributed to the improvement of Nuclear

Medicine, Radiology, Radiotherapy, Nuclear Cardiology and other technical ramifications of image production that utilizes ultrasound and MRI.

According Carlos Eduardo de Almeida, the interaction between radiological health professionals in Brazil began in the 1950, by the creation of the Brazilian Association of Medical Physics (ABFM). Between 1985 and 1987, Rozental, still the director of CNEN's, assumed the presidency of Brazilian Health Physics Association (in Portuguese, ABFM). At this time, Rozental proposed and firmed official agreements between CNEN and the Brazilian College of radiology (in Portuguese, CBR) and between CNEN and ABFM. These conventions established that the titles of specialist emitted by these organizations were recognized by CNEN. This initiative allowed an effective quality control of the physicians and physicists performance in the country.

As concluded by Ivan Salati in the documentary, Rozental has brought an elevated standard of radiation protection and nuclear safety in Brazil, as Salati believes it could be maintained until now.

The Goiania Radiological Accident

In 1987, occurred the radiological accident in Goiania, capital of the Goias state, about 300 km from Brasilia, the capital of the country. One source of Cesium 137 was left behind in an abandoned place formerly operated by a radiotherapy clinic that moved away from another local. The radioactive material remained in an abandoned open field and it was found by a group of waste-paper collectors. Ignoring the facts, they decided to sell the radioactive source and transported it to a scraped metal yard and some of them carry part of the source to their own homes. These people became very contaminated and sick, but the disease was hardly diagnosed by the physicians and the cause was unknown for two weeks. Finally, CNEN was alerted.

Rozental were assigned to travel to Goiania one day after the accident was discovered to face the episode that, as his own words, altered the national policy of radiological emergency. The documentary describes his arrival in Goiania and the physiological state of the people he found. As he describes in one article: "In the early hours of the day, I found and spoke with people isolated in stalls in the Olympic Stadium, discovering that several indicates signs of contamination. On 2 o'clock in the morning, the

first victims in the hospital were afraid and crying when they told me their afflictions and insecurity”

As being the coordinator of the CNEN’s operations, Rozental had to work with unusual technical problems. But, also, he was able to get a close human contact with the population affected by the incident. Daily, he visited the infected areas, answering all kind of doubts and drank water himself to show that it was not contaminated. He helped the population to recover his self-esteem. In 2007, in a conference in the Center of Disease Control, Atlanta, USA, he said:

“I decided everyday to save time, after the press interview, from 15.00 to 18.00 to visit families with anxiety, and I learned that physical and emotional pain cannot be measured objectively, especially when urgent protective measures are being taken in the early phase of an accident. The first thing families have offered for me was a glass of water or juice, a piece of cake, just to be sure if I accepted to drink, and to eat. Psychologically was important, for their tranquility: Can you imagine how many liters in this period I have drank? I am not sure, but at least I visited during the early and intermediate phase more than 100 residences. For a long time, I was thinking about what happens in Goiania. Even with almost 30 years of experience at the time, I never could imagine get involve by some many emotions, pressure and decisions in a level that was political, economic, technical, disbelieve in our capacity but above all others human. I could never imagine that how hard it’s to live with such human stigma”.

In the documentary, Alfredo Tranjan Filho, responsible for the construction of the radioactive waste repository, describes the relevance of Rozental to convince the population to accept the radioactive waste nearby. After the inauguration, in the area around the repository was built the West Region Nuclear Sciences Center and the Museum of the Goiania Accident Memory.

In 1993, Rozental retired from CNEN, farewells Goiania and went to Israel to meet his family. In his departure, he wrote a message to the population in the newspaper “The Popular”: “I get out. But don’t leave Goiania, never I would leave. Stay here my work fellows, my friends. Surely yet doesn’t depends on me anymore, I gave them everything I could, I teach them what I knew and I am sure that they will overcome me. Goiania is part of myself, I will leave here love and carry from here hope, lesson the Goiania people have

teach me. Goiania survived of the radiological Cesium accident despite all the difficulties. I go now to others lands, to encounter my sons, already there. I came back to my ancestor's land. I go pursuit new dreams, more experienced now. I will take everyone, take Brazil, land that I was born. I will take Goiania in my memories, memory of heroes, of brave, determined men, the sweetest people I have met. I love this land and their flowers. Forgive my selfishness I will take them with me.”

Lessons Learned and Public Communication

Between 1995 and 2001, Rozental worked as representative of the Radiation Safety and Regulation Division in Ministry of Environment in Israel and participated in many scientific committees in the International Energy Atomic Agency headquarters (IAEA). He joined the group founded by Patricia Wieland that had a goal to communicate the radiological protocols with the civil society. According her, Rozental was the main star of the project. Since Goiania, he had proffered audiences with the students to communicate the most important nuclear and radiological issues.

In following years, Rozental continued to be invited as consultant for several conferences in many countries about the lessons learned in Goiania. It was an opportunity to share with the public his knowledge, as he said in one of the many articles about the theme: “The main purpose of this article it's my conviction that we are forgetting quickly the radiological accident of Goiania, from the after events time to today, leaving the discussions about several themes, as much objectives as subjectivist, especially those that we are not able to learn from literature but happens in unexpected situations or issues that we never thought before”.

In 1997, he came back to Brazil to receive Goiania's citizen title. In 2005, from Israel, he sent a message to the journalists (Figure 2) that covered the events in Goiania: “From the Holy Land, I send my salutes and my esteem. The emotions I lived in Goiania are eternal. I am moved by scenes of the time of the accident with the Cesio-137 when CNEN looked forward to solve the activities in face of a population traumatized by the pain and discriminated by the ignorance of other interests. And you did a dynamic journalist cover. Today, analyzing things, I said that we have much to learn with the lessons of Goiania to avoid attitudes that brings pain. The technical activity causes great damage but

also create a psychological trauma and angst in a large accident like this. Your participation, in my actual analyses, comparing to other journalistic covers in other accidents in the world post Goiania, I have no doubt to said, it was conscientious to communicate all situations, ailing fare information with respect to pain of the innocents”.

On September 2th, 2007, Rozental wrote, in his last article, published on Goiania’s newspaper “The Popular”: “In a few days from now will mark the 20th anniversary of Goiania’s radiologic accident, which doesn’t have, so far, similarity with no other in terms of technical dimension and emotions lived. Many lessons were learned and incorporated by regulation authorities from over the world and by scientists linked to the nuclear field. However, other lessons still demand much of dedication and decision to be learned. Rozental died in Israel in 2010. The filmmakers believe that his lessons should be always remembered.



Rozental and guardian angels (part of the media in Goiania)

Figure 2

Acknowledgements

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References

International Atomic Energy Agency (1988), The radiological accident in Goiania, Vienna, IAEA.

Rozental Jose J. (1989), The radiological accident in Goiania, Health Physics special issue The Goiania Accident, 60(1).

Rozental Jose J. (1992), “Acidente radiológico de Goiânia: cinco anos conversando com a população”, em Symposium Nuclear Energy and the environment, 6, pp. 63-81 (In Portuguese).

Rozental Jose J. (1995), “Radiological accident in Goiania, eight years later: what developing countries must never forget”, en “Safety Culture in Nuclear Installations”, International Topical Meeting/American Nuclear Society, pp 24-28.

Rozental, Jose J. (1998), “Adjusting ability and sensibility in case of an accident”, en Proceedings of an International Conference, Goiania Ten Years Later, International Atomic Energy Agency, pp. 159-164.

Rozental Jose J, Wieland P., Mezrahi A. et al. (2001), Building competence in radiation protection and the safe use of radiation sources. Vienna, IAEA.

Rozental Jose J. (2002), “Two decades of radiological accidents direct causes, roots causes and consequences”, Brazilian Archives of Biology and technology, special issue 45, pp 125-133.