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## **Nationalization of Brachytherapy Radioactive Sources in Brazil and the Importance of IAEA Cooperation**

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Brazil has a cancer incidence of about 625,000 cases a year. It is a public health problem, demanding constant efforts to deliver for patients the most efficient treatment modalities, improving their life expectancy and quality. Brachytherapy is a type of Radiotherapy where the radioactive source is placed close to or inside the tumor. The main advantage of the technique is to deliver the maximum dose in the target, saving healthy tissues. In Brazil, Our group had the objective of producing sources nationally, diminishing treatment costs, enabling the treatment to more patients. Some of our projects are developed in collaboration with the International Atomic Energy Agency-IAEA by technical cooperation projects. The IAEA participation is very important to provide technological transfer through scientific visits, expert missions, and contacts with more advanced centers. The financial support is also important, allowing us to buy the necessary equipment to make these cancer treatment sources production feasible in Brazil. Our team has received training through fellowships. We received some experts and organized several workshops to propagate the Brachytherapy technique at national and Latin American level. For producing new sources, five major areas must be considered: 1) source production: nuclear activation and/or radiochemical reaction; 2) welding; 3) quality control: leakage tests; 4) dosimetry and metrology; 5) operational procedures; 6) validation studies. To perform all steps, a multidisciplinary team works together to overcome difficulties. Our major projects are: Iridium-192 pellets: In Brazil there are 150 afterloading machines with pellets that replacement every 4 months (about 450 Iridium-192 sources a year). Our new production line, with the support of IAEA, is in progress, with the hot-cell being installed in a brand-new facility. Iridium-192 wires: In production since 1997, also supported by IAEA. The wire is activated at IPEN's IEA-R1 reactor for 30 hours with  $5 \times 10^{13} \text{ n/cm}^2 \cdot \text{s}^{-1}$  neutron flux resulting in 7.1 GBq (192 mCi) maximum activity. Iridium-192 seed: New seed for ophthalmic cancer treatment. The core presented 90% activity homogeneity. We are making the experimental dosimetry and Monte Carlo simulation. Iodine-125 seeds: Largely used in low dose brachytherapy. I-125 binding yield achieved with our new reaction was 90%; Laser welding presented 70% efficiency. Approved in all leakage tests. Our Iodine-125 seeds laboratory production is 90% ready. Other ongoing projects: polymeric Phosphorus-32 source for spinal cancer treatment, Gold-198 nanoparticles for prostate, breast, and liver cancer treatment, Iodine-125 seed as markers for non-palpable cancers, and dosimetry calculations for all new sources. All the projects are advancing, despite national funding difficulties. Withing those, several mSc, Phd, and Post-doc are getting their degrees. We will continue to develop new products hoping to help the Brazilian population fight against cancer. The support of IAEA has proven to be of the utmost importance for these projects not only in direct funding, but in providing knowledge to our team, the possibility to share information with the scientific community, and to form the next generation of scientists.