

CURRENT STATUS AND PERSPECTIVES OF CYCLOTRONS FACILITIES IN BRAZIL AND THE SOCIOECONOMIC IMPACT

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ACCELERATORS FOR RESEARCH AND SUSTAINABLE DEVELOPMENT

From good practices towards socioeconomic impact



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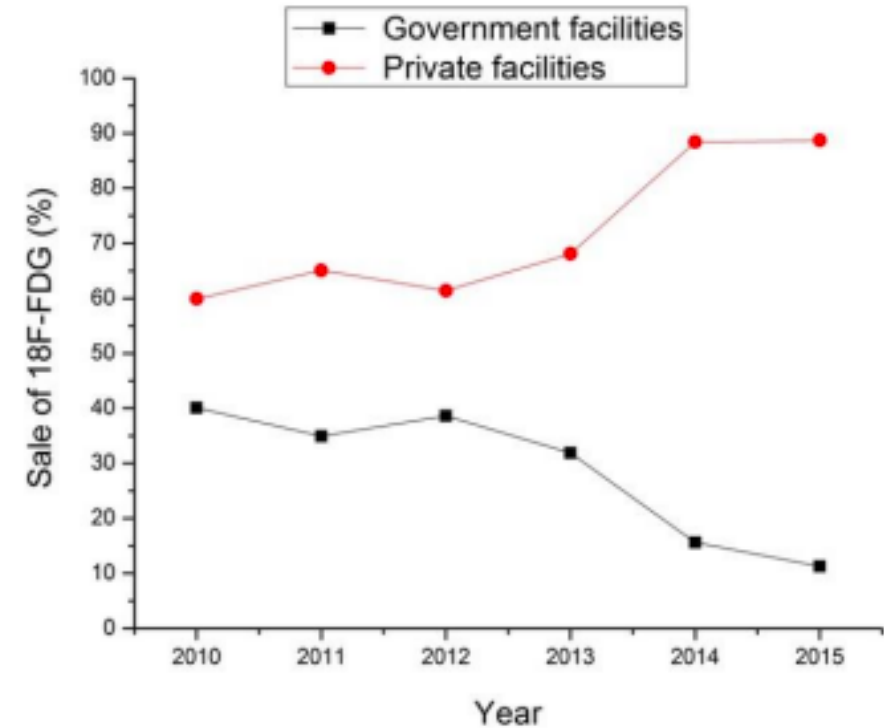
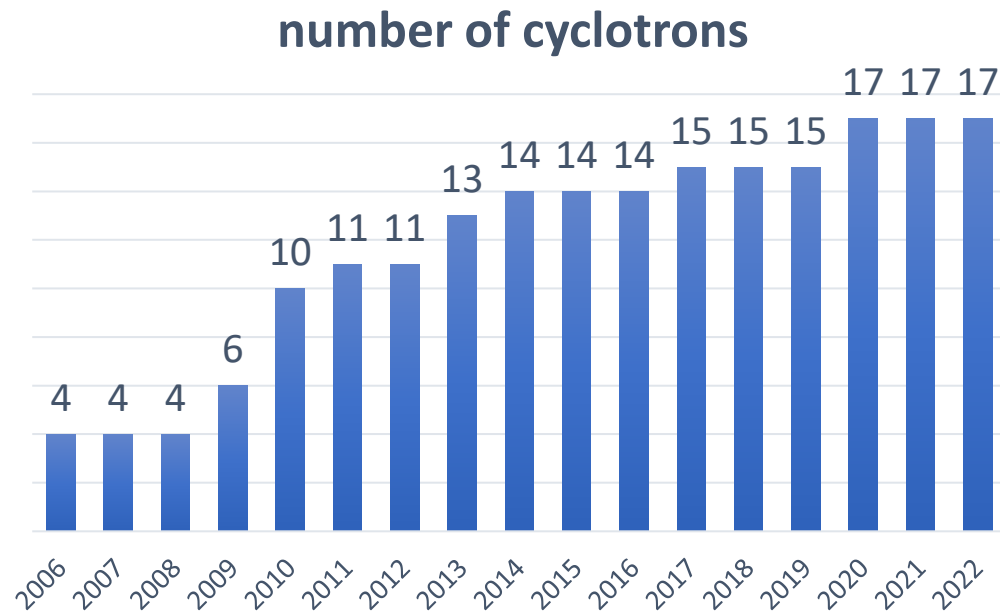
Brief history of radioisotopes production in Brazil..

Until 2006 the production and commercialization of radioisotopes was a federal government monopoly (CNEN).

- 1 Industrial Radiopharmacy in São Paulo (I-131, Mo/Tc generator)
- 2 Cyclotrons (São Paulo and Rio de Janeiro)

Logistical Problems: Critical point for large countries.
It is very expensive to send radiopharmaceuticals that are decaying
with the time to distant nuclear medicine centers

In 02/2006, with constitutional amendment, the monopoly for short half-life radioisotopes production (less than 2 hours) ended.



Private facilities have taken up market demand. Now the governments' cyclotrons are mainly directed to research and development of new radiopharmaceuticals

There are 17 cyclotrons facilities for medical radioisotope production in Brazil:

- 13 in operation
- 3 under construction
- 1 started the decommissioning process



Big challenge. It will be the first complete decommissioning of cyclotron facility in Brazil



SOCIOECONOMIC IMPACT



As well as the producers (cyclotrons), the number of PET-CT has increased but are also concentrated in the South-east



It makes it difficult for distant population to access nuclear medicine procedures (PET-CT exams)

Hampers the expansion of new nuclear medicine centers in other regions

Production characteristics

City	Status	Cyclotron	Radioisótopes
Brasilia/DF	In operation	SIEMENS - RDC - 11MeV	F-18
Fortaleza/CE	In operation	SIEMENS - RDC - 11MeV	F-18
Campinas/SP	In operation	SIEMENS - RDC - 11MeV	F-18
São José do Rio Preto/SP	In operation	GE - PetTrace - 16,5 MeV	F-18
Xerém/RJ	In operation	GE - PetTrace - 16,5 MeV	F-18
Pernambuco/PE	Under construction	IBA - Cyclone - 18Mev	F-18
Mogi/SP	Under construction	IBA - Cyclone Kiube - 18 MeV	F-18
Porto Alegre/RS	In decommissioning	IBA - Cyclone - 18Mev	F-18
Curitiba/PR	In operation	GE - PetTrace - 16,5 MeV	F-18
Porto Alegre/RS	In operation	GE - PetTrace - 16,5 MeV	F-18 / C-11
Salvador/BA	In operation	GE - PetTrace - 16,5 MeV	F-18
Recife/PE	Under maintenance	IBA - Cyclone - 18Mev	F-18
São Paulo/SP	In operation	IBA - Cyclone 30Mev / Cyclone 18 Mev	F-18 / I-123
Rio de Janeiro/RJ	In operation	SIEMENS - RDC - 11MeV / CV 28	F-18 / I-123
Belo Horizonte/MG	In operation	GE - PetTrace - 16,5 MeV	F-18 / C-11
São Paulo/SP	In operation	GE - PetTrace - 16,5 MeV	F-18 / C-11 / Ga-68 / N-13
Itupeva/SP	Under construction	GE - PetTrace - 16,5 MeV	F-18



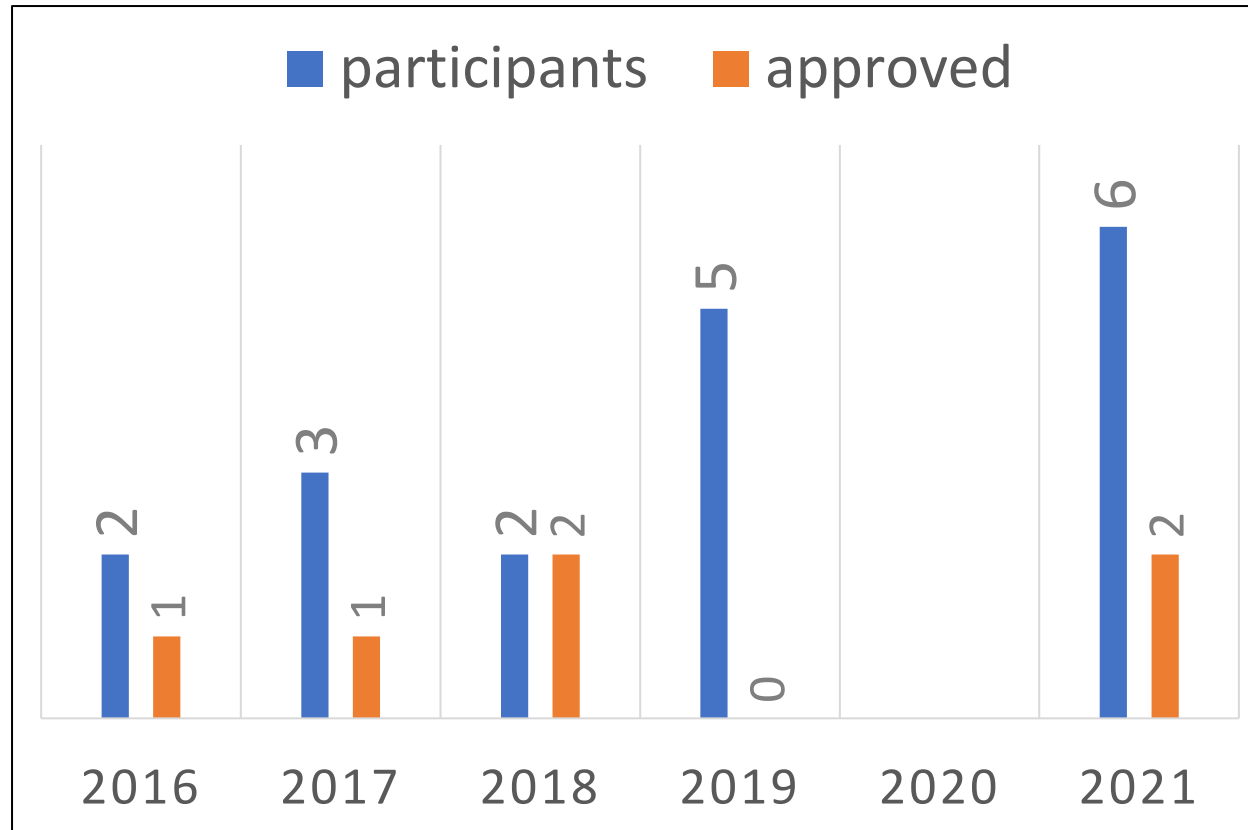
Production characteristics

- The facilities are investing in moderns equipment and approaches looking to improve the development of new radiopharmaceuticals in Brazil. With this objective, many facilities maintain research agreements with universities with a focus on training new professionals.
 - There are 4 cyclotrons located inside the university's campuses



Professional capacitation

Numbers of certification process for radioprotection officer for cyclotron facilities



TOTAL: 23 certified professionals

Licensing Aspects

NORMA CNEN NN 6.11

REQUISITOS DE SEGURANÇA E PROTEÇÃO RADIOLÓGICA EM INSTALAÇÕES PRODUTORAS DE RADIOISÓTOPOS COM ACELERADORES CÍCLOTRONS

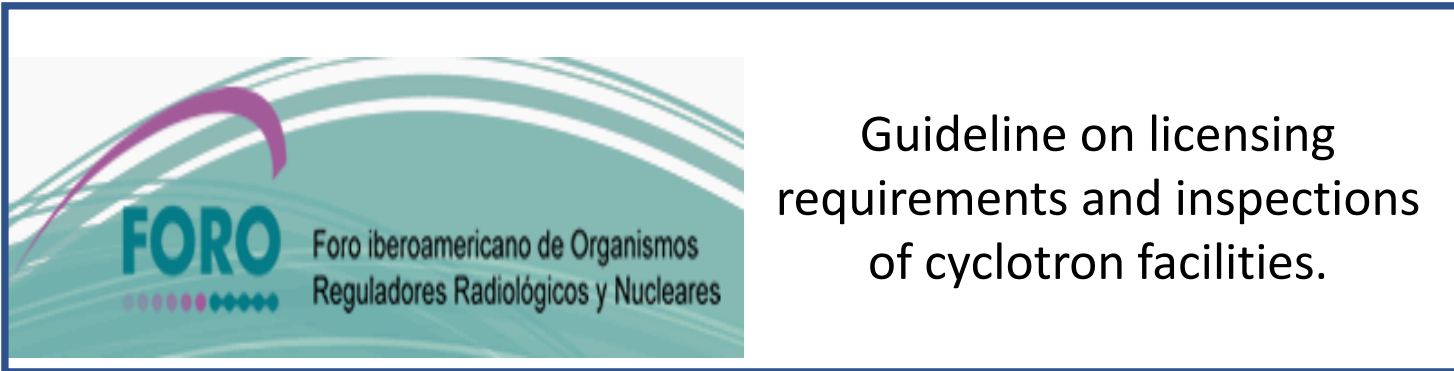


SAFETY REQUIREMENTS AND RADIOLOGICAL
PROTECTION IN RADIOISOTOPE PRODUCTION
FACILITIES WITH CYCLOTRONS ACCELERATORS

Dispõe sobre os requisitos de segurança e proteção radiológica em instalações produtoras de radioisótopos com aceleradores cíclotrons.

Art. 1º Esta norma foi aprovada pela Comissão Deliberativa da Comissão Nacional de Energia Nuclear, conforme expresso na Resolução 267, da sessão nº 662, de 14 de outubro de 2020.

- Location approval
- Construction
- Commissioning
- Operation
- Decommissioning



Inspections

Steps of licensing process

- Construction
- Commissioning
- Operation
- Decommissioning

Frequency

- After 6 months from the begins of the production
- Annual
- After modification in safety requirements



Conclusions

- The nuclear medicine in Brazil is expanding, the perspective is the increase the number of nuclear medicine centers and more investments in the development of new radiopharmaceuticals
- The same for cyclotrons, the perspective is the increase the number of new cyclotrons aiming to serve the most distant regions
- To improve the aspects of the regulation with the same speed with the field changes



Thank you!

Acknowledgements:

- IAEA
- CNEN

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