

# REGULATORY CONTROL AT THE CONSTRUCTION STAGE OF A RADIOPHARMACEUTICALS PRODUCTION FACILITY WITH CYCLOTRON IN THE CONTEXT OF COVID-19 PANDEMIC

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## ACCELERATORS FOR RESEARCH AND SUSTAINABLE DEVELOPMENT

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# INTRODUCTION

- In Argentina, a radiopharmaceutical production facility with cyclotron **requires an authorization for construction from the regulatory body (ARN)**.
- This construction stage includes the development of **civil works** and the **assembly of equipment and components**.
- **In March 2020**, ARN granted the authorization of construction to **begin the civil work of 'Cyclotron - Radiopharmacy Laboratory' from Oulton Institute** located in Córdoba City.
- Since March 2020, restrictions to the circulation due to the **COVID-19 Pandemic** were established, which **affected the development of on-site regulatory tasks**



# CRITERIA

During the design phase, some considerations have to be taken into account, also about the construction of the cyclotron vault:

## 1. A cyclotron vault must be a monolithic structure,

- It was necessary to erect the vault in **layers of concrete**.
- **Deficiencies in the contact surfaces** of the concrete layers could affect the shielding capacity of the vault.
- It was agreed to insert a **double wooden frame inside the steel armor**, along the perimeter of the vault to produce 'steps' that avoid interface plans between the layers of concrete.
- The height of the layers, **must not match the interface surfaces with the proton acceleration plan** of the cyclotron and its targets.
- To **vibrate the concrete** is requested during the pouring to prevent air bags.



# CRITERIA

## 2. Formwork and shoring systems must not reduce the shielding capacity,

- It is common in civil constructions the use of metallic tensors to grew the resistance of the concrete containment during the pouring and simplify the formwork assembly.
- These **tensors remain in the shielding structure** and might produce **possible radiation leakages** due to metal corrosion.
- It is requested to **replace the use of tensors for extern shoring systems** that have to be able to resist the concrete pressure



# CRITERIA

3. **Assembly of ins and outs ducts to the vault must prevent the leakage of neutrons,**
  - The route of **ins and outs ducts** to the vault **must adopt three 90-degree turns** over the cardinal axes preventing neutron leakages
4. **Future decommissioning tasks must be foreseen,**
  - ARN requested the facility to include a **sacrificial layer** in the vault project
  - **Concrete blocks with a particular design** allows the interior walls of the vault to be covered easily
  - It is expected the use of **local shieldings for FDG production targets.**



# INSPECTIONS & REGULATORY CONTROL

- **Inspections during the construction stage** and especially prior to the pouring of the concrete, allows the regulatory body **to verify the fulfillment of the criteria** described.
- **Restrictions due to COVID-19 pandemic** made it **difficult** to travel to Córdoba city to carry out **on-site inspections**.
- **Alternative solutions** in order to continue with the regulatory control adequately, **were required**.
- The 'Class I Particle Accelerators Sector' of **ARN followed the execution of the civil works remotely** by reviewing photographic reports that the facility sent to the ARN continually.



# INSPECTIONS & REGULATORY CONTROL

- It was extremely important that workers in charge of taking these photos understood what needed to be depicted in them.
- For this purpose, a **remote meeting between inspectors of ARN and the civil work staff** was made.
- The following pictures show the fulfillment of the criteria, according to the approved project.



# INSPECTIONS & REGULATORY CONTROL



*Wooden frame inside the armor previous the concrete cast*

# INSPECTIONS & REGULATORY CONTROL



*Wooden frame inside the armor previous the concrete cast*



*'Step' generated by the wooden frame*



*A civil worker vibrating the concrete during the cast*

# INSPECTIONS & REGULATORY CONTROL



*Shoring system to  
extern vault wall*



*Shoring system to  
intern vault wall*



*Absence of intern  
metallic tensors*

# INSPECTIONS & REGULATORY CONTROL



*Ins and outs ventilation ducts from the vault*

# INSPECTIONS & REGULATORY CONTROL



*Concrete blocks for 'sacrificial' layer*

# CONCLUSIONS

- The **objectives** of the regulatory control during the vault construction were **successfully fulfilled**.
- The current **criteria** in the matter were properly considered and **adapted according to the needs and the technical limitations**, as it could be observed.
- The **Covid-19 restrictions forced inspections processes to be adapted** and the results obtained by the 'Class I Particle Accelerators Sector' of ARN in the control of construction stage tasks have been very positive until now.
- Fortunately, the restrictions have been already released and the inspectors of ARN could verify on site the construction progress.



# CONCLUSIONS

- Currently, the **construction authorization is still valid** and this stage continues by the assembly of the radiopharmacy systems and the radiological protection equipment.
- The cyclotron is already placed and also the hot cells of the radiopharmacy lab.
- At **April of 2022**, the external contractors are finishing their construction jobs and **the commissioning authorization has been already requested to ARN**



# Thank you

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A special recognition to Oulton Institute

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