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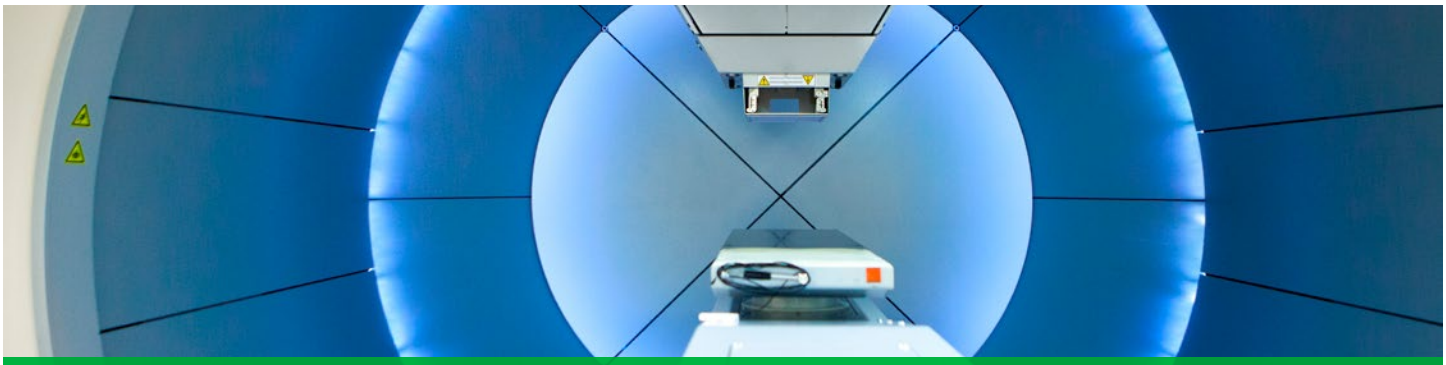

Science + Technology Perspectives

Hot Topic: Cyclotron Facility Design

The use of radioactive markers to detect disease in the human body is increasing as medical diagnostics get more sophisticated. Many of these radioactive markers, or radio pharmaceuticals, are created using a cyclotron. According to the International Atomic Energy Agency (IAEA), cyclotrons "use electromagnetic fields to propel charged particles to very high speeds and energies," a.k.a., particle acceleration.

Designing a facility to house a cyclotron and facilitate the processes involved with the management and development of radioisotope material requires special considerations. In fact, Hixson Senior Project Architect LT Thorn, likened one cyclotron facility recently designed by Hixson to a Swiss watch: "It's a small facility," said LT, "but there is a lot of complexity to it, and everything needed to be just right."

What exactly are some of those things that have to be "just right?" Below is a high-level look at some of the factors that must be addressed when designing a cyclotron facility:

- **The building and infrastructure**. Because radiopharmaceuticals must be used within a very short timeframe, the facility must be designed to allow fast production and dispensing of the materials. Key considerations of building design include:
  - **Flows of Material and Work.** With cyclotrons, there is typically a constant inflow/outflow of materials. Creating safe, efficient flows of material and work processes are a key consideration with the creation of a cyclotron facility.
  - **The Vault.** The room housing the cyclotron - known as the cyclotron vault - should be built using thickened concrete slab walls to protect against radioactive leaks. In addition, the room requires cleanroom level finishes and components for all elements of the room, including floor coverings, ceiling panels, drains, etc.

- **Code implications.** The facility design will need to conform to traditional codes/regulations, but will require intensive engineering to address multiple International Organization for Standardization (ISO) rating requirements.

- **Heating, Ventilation and Air Conditioning (HVAC) and Air Pressurization.** HVAC and air pressurization concerns are of paramount importance for any facility housing a cyclotron.
  - Following ISO standards, HEPA filtration will be required within various rooms in the facility.
  - Cleanroom design protocols should be followed for the vault and lab spaces, with air supply coming from the cleanest area, and exhausting near the point of greatest potential contamination.
  - In addition, the vault should have an airlock entry, walls constructed from materials such as Fiber Reinforced Plastic (FRP) panels, with specially sealed joints. Resinous flooring for cleanability is also desirable.

Ultimately, what does all this mean? In short, cyclotron facilities are expensive propositions. It's important to know what you're getting into and how to best design the facility for maximum Return on Investment. The IAEA recommends the involvement of an experienced architecture/engineering firm to help guide you through the facility development.

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