Renovation Of A Medical Radioisotope Production Hot Cell

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Overview

In 1970 the Belgium Institute of Radio-elements (IRE) contracted Robatel to construct a Xe/Mo production facility. Decades later, despite on-going maintenance, it became necessary to perform a major renovation of the facility to ensure compliance with current and future regulations, upgrade safety systems and position the facility for continued operations for several more decades.
Some Background

- Robatel was original design engineer and fabricator.
- Robatel was selected to perform the major renovation.
- Robatel’s original construction included proprietary self-supporting lead panels.
- Internal cell/liner is more appropriately classified as a glovebox within a lead box.
Schedule

• Refurbishment contract let in 2000
• 24 months planning.
• 3 production lines (5 cells) involved.
  – C7 – 2 cells for Sr/Y 2009.
  – Xe/Mo – 3 cells 2009 & 2010.
• Production lines maintained on alternating 5 – 7 year maintenance schedules.
Technical Issues

• Out of compliance w/ leak tightness standards.
• Air flow issues.
• After work initiation, radiation damage identified with:
  – Electrical wiring
  – Insulation and connectors
• 7 year non-use and decay resulted in non-existant dose rates and contamination in one cell.
• Contamination was issue in another.
C12

- Dual cell with ventilated storage and alpha glovebox.
- Renovated 2002, first to be performed.
Decontaminate & remove existing enclosure (cell liner).
C7 (2009)

- Partially dismantled and modified lead shielding.
- Original stainless steel enclosure removed.
- Replacement enclosure had several unique features:
  - Divider forming two cells within a cell.
  - Stainless steel base in both.
  - PVC lined in one.
- Transfer tunnel fabricated with PVC.
- Shielded rotating airlock.
C7 Pre-renovation
Front view before renovation
Dismantle rear shielding wall.
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Installation of new internal liner creating two sub cells.
Renovating a medical Radioisotope production Hot Cell
Installation of rotating airlock, manipulators and ancillary equipment.
C7 Work Flow

• Installation of new wiring, control cabinets and connectors.
• Connection to ventilation system.
• Leak test.
• Functional testing.
• Final commissioning.
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Xe/Mo-II (2009/2010)

• Overall renovation/upgrade of cell internals.
• Compliance with most current regulations.
• Improve leak tightness of facility.
• Radiation levels (direct and smearable were an issue).
• Cell was in active use immediately before renovation unlike C7.
• 9 primary activities.
Xe/Mo-II (2009/2010)

1. Replace primary components (penetrations, gaskets, etc.).
2. Replacement of pneumatic components with mechanical (i.e. doors).
3. Drain Tanks
5. Upgrade of lighting system.
6. Upgrade of electrical system.
7. Leak detection devices on waste tanks and the primary enclosure.
8. Replace flow meters, 1-way valves, pressure gauges, piping.
9. Leak test.
A Few More Xe/Mo Details

• Project completed in 12 months. 6 months longer than planned due to radiation levels.

• Work required positive pressure suits.

• Ingress/egress airlock.

• Alarming digital dosimeters in addition to standard dosimetry.

• Urinalysis for strontium.
Project Common Details

- Jointly prepared between Robatel & IRE staff.
- Cold commissioning in Robatel’s facility before shipping to site.
- C7 work required only gloves, paper filter masks and regular work clothes.
- Xe/Mo required positive pressure anti-c, digital dosimeters and airlock.
- All project doses were < 10 mSv. Site administrative limit.
- No positive urinalysis.
Conclusion

- **C7**
  - 7 months and 8,700 man-hours (Robatel) & 1,000 man-hours (IRE).
  - Out of service 7 years prior to renovations
  - 94 bags of burnable waste.
  - 15 drums other wastes

- **Xe/Mo-II**
  - 12 months, originally 6
  - Rad levels extended schedule
  - Active service up to renovations
  - Experimental work with Sr/Y
  - 9,250 man-hours (Robatel) & 3,500 (IRE)
  - 1,500 bags of burnable waste (~30m³)
  - 20 drums of other waste
Conclusion

• Close collaboration between facility staff & Robatel reduced misunderstandings, impacts to production, enhanced performance.

• Coordination of support activities eliminated mis-steps.

• Weekly staff meetings of key project leaders.

• Special meetings for unique activities.

• Integration of radiation control into work planning contributed to minimum dose and no internal exposures.