CRL Shielded Facilities
Refurbishment Project

UC & FMC Facilities
2008 September
Facilities

18 Hot Cells

Canada’s only PIE Facility

Experienced Staff

Over 40 years PIE experience
Universal Cells Facility
Universal Cells Facility

• 3 Large hot-cells
  – Cells 1 & 2: 3 x 2 ½ x 4 ½ meters each.
    (adjoining door for use of full length of both cells)
  – Cell 3: 5 x 2 x 4 meters
• Each cell rated for 100 kCi Co-60
• UC 1 & 2 were constructed in 1956 and UC3 was added in 1962. They were designed to be flexible, accommodating a wide variety of flasks, up front visual inspection, testing and disassembly activities.
• UC 1 primarily dedicated for Cobalt Processing
• UC 2 used for transfers to UC1, visual inspections and fuel disassembly.
• UC 3 used for handling full length fuels to perform visual inspection, testing and disassembly activities. In addition, pressure tube and waste re-packaging work is also performed.
UC – Cells 1 & 2

- Receives Commercial shipments
- Processes Co-60
- Waste repackaging
UC - Cell 2

Photo shows Receiving OPG Road Runner Flask.
UC - Cell 3

- Initial PIE activities
- Visual examinations
- Profilometry
- Experiments
- Reactor maintenance
UC - Cell 3

Removing element and installing onto profilometer

Welding thermocouples to an irradiated fuel element
Upgrade UC (Bldg 234)

- Ventilation Systems – Replacement of Cell Exhaust Systems,
- Air monitoring – CAM Replacement,
- Cell confinement – Sealing Cell Doors & Replacing Isolation Rm. Doors,
- Class 3 & 4 Power Supply Systems – Replacement of Obsolete Equipment,
- Replacing Fume Hoods and adding 2 walk-in Fume Hoods
- New Stereomicroscope For Cell 3
UC3 Exhaust Fan
Isolation Room Doors
Electrical Substation & Distribution Panel
New CAM’s
UC Fume Hood Replacement
New Stereomicroscope

General Assembly Drawings
Fuels & Materials Cells Facility

14 Specialized hot cells

Dedicated to PIE & mechanical testing

Supported by experts in fracture analysis, metallography, Chemistry, corrosion and wear
PIE Capabilities - Fuel

- **Visual Exams & Dimensional Measurement**
  - Examine deformations from internal gas, and bowing,
  - Deformations affect thermal/hydraulic performance
  - Bearing pad wear

- **Fission Gas-Puncture**
  - High internal gas pressures lead to stress corrosion cracking, and high fuel temperatures from reduced conductance to sheath
  - Analyze Xe, Kr, CO₂, H₂ content by mass spec
PIE Capabilities - Fuel

• **Burn-up Analysis**
  – To verify power history & validate code predictions.
  – Chemical analysis of dissolved sample by HPLC, focusing on $\text{La}_{139}$

• **Gamma Scanning**
  – Yields from axial flux shape, distribution of isotopes, end-flux peaking, locate inter-pellet gaps and pellet cracks

• **Sheath Metallographic Examination**
  – Microstructure characterization
  – Optical microscopy
  – High resolution alpha & beta/gamma auto-radiography
PIE Capabilities – Fuel

- Sheath Hydrogen & Deuterium Analysis
- Sheath oxide depth (FTIR)
- Fuel Ceramographic Examination
- CANLUB Examination
- Scanning Electron Microscope (EDS & WDS)
  - Fission product deposition/migration
PIE Capabilities – Fuel Channels

• Visual Examination.
  – Wear patterns, bearing pad frets, debris frets
  – Crevice corrosion

• Optical Microscopy
  – Flaws
  – Hydride distribution

• Scanning Electron Microscopy
  – Topographical and compositional analysis
  – Examination of fracture surface
PIE Capabilities – Fuel Channels

• **FTIR**
  – Measure oxide depth
  – Measure tube ID & OD

• **Scrape analysis**
  – DSC measures hydride & deuterium content

• **Mechanical Testing**
  – Fracture toughness, fatigue, tensile testing
  – Delayed Hydride Cracking program
  – Burst testing program
FMC PIE Equipment

Gas Puncture Rig
FMC PIE Equipment

Burn-up Dissolver

Metallographic polisher
FMC PIE Equipment

Cell 1 Microscope
FMC PIE Equipment

Shielded Scanning Electron Microscope (SEM)

SEM without shielding in lab 160
PIE Equipment

Metallograph (remote optical microscopy)
Fuel Element Cross section with through-wall defect
Pressure tube hydride growth pattern

Crack growth in notch from UTS testing
Upgrades FMC (B375)

- Replace all CAM’s
- Material Handling Crane Replacement
- Active Liquid Waste Upgrade or Replacement
- Ventilation System Upgrades including a New Carbon Absorbers for FMC-3.
- Transfer of FMC-2 Work to Other Hot Cells
- New Stereomicroscope for FMC-1
- Replacement of Fume Hoods
New CAM’s
Material Handling – Dinny Crane
FMC Active Liquid Waste System
FMC Exhaust Ventilation
New Stereomicroscope FMC-1

General Assembly Drawings
FMC Fume Hoods