Installation of an Endoscope in Universal Cells at Chalk River

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2012 September
Topics

- Initial Considerations
- Camera Selection
- Canadian Codes/Standards
- Quality Assurance Requirements
- Installation
- Summary
Initial Considerations

- Location of the camera within the cell interior
- Wall penetration, hole dimensions & wall material (use of an existing cell thru wall port/penetration vs the minimum port diameter required)
- Type of objects, their locations & level of detail required
- Environmental conditions of the hot cell
- Safety Considerations: Hot cell facility shielding is considered safety related & therefore must meet the requirements of CSA N286 as far as design with an appropriate manufacturing inspection test plan
Selection of Camera System

- The ASTM (American Society for Testing and Materials) standard C1661 provided direction for determining the type of system to consider for our application.

- No cell entry desired for installation with an existing thru wall port/penetration.

- Minimum port diameter required (~4 “).)

- Repair versus life expectancy.

- Ease of use.

- Waste generated over the life of the device.

- Cost.
Interfacing the ASTM of Viewing Systems for Remotely Operated Facilities

FIG. 7 Typical Through-wall Camera (Cross Section View of Encast Liner and Filler Liner Shown)
Interfacing the ASTM of Viewing Systems for Remotely Operated Facilities

FIG. 4 Wall-Mount Camera Configured for Remote Handling
Hide & Peak Design
Canadian Codes

• CSA N286-05 Management System Requirements for Nuclear power Plants was used for the shielding components

• National Building Code of Canada (NBCC) was used to address the loads on the components during a seismic event given as an acceleration as a function of gravity

• Canadian Electrical Code (CSA 22.1 & 2)

• OESC 24th Ed Ontario Electrical Safety Authority
North America uses ATSC standards developed by the Advanced Television Systems Committee for hi-def TV.
The CSA N286 standard quality assurance section had to be applied to all shielding components.

Companies that had not previously supplied to the Canadian nuclear industry were not familiar with N286 standards resulting in bidding challenges.
Requirements:

- Shielding analysis report
- Method of analysis - computer modeling (Monte Carlo or Microshield)
- Validation/verification report for the computer model used for the report
- Qualifications of personnel responsible for authorship, review and approval
- MITP - traceability of material, mill test reports & independent QA dimensional inspections of manufactured components (reports)
- In cell Shielding Integrity Test
Shielding In Cell Requirement
Meeting the Canadian Electrical Code

- CSA electrical code requires devices & components to have an authorized CSA stamp of approval

- Required electrical components usually can be sourced using the internet from companies that have CSA approval

- Wiring conventions, including color coding, must be followed
• The Ontario Electrical Code has an exemption for electrical circuits with a power of less than 100 V*A. Every electrical device after the step down transformer is therefore exempted from Ontario Electrical Safety Authority inspection and approval

• Unique or proprietary components can be certified by laboratories such as Underwriters Laboratories whom would provide a ULc certification
CSA Approved Equipment Symbols
CSA in Practical Terms
Quality Assurance Requirements

- ISO 9001
- Manufacturer audited to ensure requirements of CSA N286 could be met for design & manufacturing of shielding components
- MTIP or FAT witnessed
- History docket review prior to shipment of the device
- Inactive & active commissioning performed at Chalk River by manufacturers technician & AECL staff
ISO Visual Test Chart
Replacement of a Periscope with an Endoscope in the Universal Cell #3
Old Periscope Port
Hide & Peak Camera Selected
Actual Endoscope without Mounting Flange
Dome Replacement & Camera Insert Removal for Repair
Cabinet Tamper Proofed
Computer Control Cabinet
Endoscope Installed between Cell Windows
Close up of Cell Wall Flange Mount
Wide Angle View (no Zoom)
Full Zoom
Ability to See the Top of the Cell
When Considering a Camera Installation:

• Know what you want to see & how closely you want to see it.

• Determine your ports in the cell & the optimum position for the required views

• Understand your code requirements & their application

• Know the camera system formats & your functional requirements
• Understand the level of QA required for your nuclear facility & how to apply it with a standard ISO program with special amendments

• Determine the best approach regarding cost/maintenance when making the camera selection

• Perform FAT, Site Inactive & Active Commissioning to ensure successful operation and training of maintenance & operation personnel
If Considering a Camera Installation:

Questions?