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ELECTRONIC DATA COLLECTION FOR AECL NRU RESEARCH REACTOR

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1. Introduction

Atomic Energy of Canada Limited's (AECL's) National Research Universal (NRU) Research Reactor has been operational at Chalk River since 1957. Although a number of reactor instruments have been replaced over the years, the majority of the instrumentation is original (circa 1950's). Many of these instruments are in the form of dials, gauges and chart recorders, providing analog readouts which do not have the ability to be captured in real-time.

Prior to the implementation of an electronic data collection program in NRU, daily surveillance and monitoring were performed by Nuclear Operators using hardcopy reading sheets. Although data points were available for trending, this hardcopy format was not conducive to proactive monitoring of equipment health, as there was a significant delay from when the data was recorded to when it was accessible for trending.

The NRU Electronic Data Collection program is part of a broader long-range Equipment Reliability strategy developed to maintain facility assets and minimize equipment failures.

2. Data Collection Process

NRU daily surveillance readings consist of thirty-nine (39) readings sheets which are broken into six (6) separate reading sheet groups. There are 971 unique instrument readings and approximately 7,200 scheduled readings per day.

For migration to electronic data collection, 2D Aztec barcodes, engraved with the instrument identification number (Figure 1), were applied in close proximity to the corresponding equipment in NRU. These barcodes are designed to be read using an optical scanning device, and when scanned, contain information specific to that piece of equipment.

Once all readings are collected for a given route, the information is synchronized and stored in an electronic repository. A web-interface, called the Operator Rounds Database (ORD), allows the collected information to be reviewed, approved and trended.

Figure 1 Example of Barcode for Electronic Data Collection

3. Operator Rounds Database

The Operator Rounds Database (ORD) assists in the collection, trending and monitoring of system parameters. The notable features that improve the efficiency and effectiveness of the electronic review process (compared to the previous hardcopy process) include:

- Status indicators for each reading (alarm status; indication that additional information is available; approval status);
- Automated trending of equipment readings (by current shift and/or thirty (30) day historical view);
- High/Low engineering ranges are displayed on the trend (as a red background) if they are known and within the current trend scale;
- Ability to filter data by: Group, Reading Sheet, System or individual equipment name;
- Ability to highlight and 'jump' to any unapproved readings;
- Data can be accessed (by named users) through any computer with access to the network, and by multiple users at any time.

4. Implementation

In March 2012, NRU Operations began the transition from the hardcopy reading sheets to the electronic data collection process. A phased approach to implementation was taken over a five month period. One reading sheet group was introduced at a time; facilitating any required changes to be made quickly and enabling Operations to become comfortable with the process.

Once three of the six reading sheet groups were rolled out, implementation was paused to make some significant improvements to the handheld software, as requested by NRU Operations.

By August 2012, the remaining three reading sheet groups were successfully transitioned and the hardcopy collection process was discontinued by the NRU Operations. All routine operator readings continue to be taken electronically.

5. Technology acceptance

Although technical difficulties with both the software and hardware functionality arose throughout this transition, the greatest risk to implementation was the level of technology acceptance demonstrated within NRU Operations.

To mitigate this risk, formal awareness and training sessions were held with the Nuclear Operators and Senior Reactor Shift Engineers (SRSEs). A five-week field trial was also conducted prior to implementation, allowing the technology to be validated in the field and providing hands-on training to Operators.

AECL also collaborated with the University of Toronto on a 'Technology Acceptance' study which focused on the Implementation of the Electronic Data Collection program within NRU. Through this study, a number of key areas of improvement were identified and executed in order to gain higher technology acceptance from NRU Operations.

Lessons Learned

Lessons learned throughout the implementation of this project include:

- Engage stakeholders early (especially those directly affected) and understand the project's impact on other groups;
- Ensure visibility of the project lead within the Facility to help develop relationships and gain the trust of those affected;
- Resolve any known issues in a timely manner. Open and honest communication throughout the resolution is crucial;
- Listen to feedback and suggestions from Operations. Focus on small wins first to increase buy-in while continuing to work on larger improvements.

7. Conclusions

Prior to the implementation of an Electronic Data Collection program in NRU, daily surveillance and monitoring was performed by Nuclear Operators using hardcopy reading sheets. Implementation of this program in NRU was successfully completed in August 2012.

The collected data can be accessed through any computer allowing for close to real-time monitoring of data for 971 unique instruments and approximately 7,200 data points per day. There are currently over 1,000,000 readings available in the Operator Rounds Database.

This data is currently used by NRU Technical Support and NRU Operations to increase equipment reliability within the Facility and decrease unexpected Reactor downtime.

Software improvement initiatives are underway in order to increase the ease and efficiency of Operator readings. An Electronic Data Collection program is currently in progress for the Molybdenum-99 Production Facility, and it is expected that this program will be rolled-out to other licensed facilities on site in the future.

8. References

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