ISOTOPIC MAPPING PROGRAM AT PRAIRIE ISLAND NUCLEAR GENERATING PLANT

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ISOTOPIC MAPPING PROGRAM BACKGROUND

- Prairie Island purchased the H3D instrument in 2013 to verify the adequacy of the temporary shielding installed during refueling outages
- Radiation Protection staff discovered many other valuable applications of the 3-D individual isotopic mapping technology:
  - Identifying contamination in plant work areas including hot particles and hot spots
  - Surveying shipments of refueling equipment to ensure proper labeling and that the radioactive contents were correctly characterized
- Worked with the North American Technical Center (NATC) to set up a Cadmium Zinc Telluride (CZT) working group to share experiences.

NATC CZT DATA ANALYSIS WORKING GROUP ESTABLISHED

- In January 2015, after the Information System on Occupational Exposure (ISOE) ALARA symposium at NATC, a CZT Data Analysis Working Group was established
- Collected charter members by June 30
- Organized monthly conference calls on the 2nd Wednesday
- Discussed each site experience with 3-D imaging during the past month
- Lessons learned and good practices are documented on a website maintained by NATC

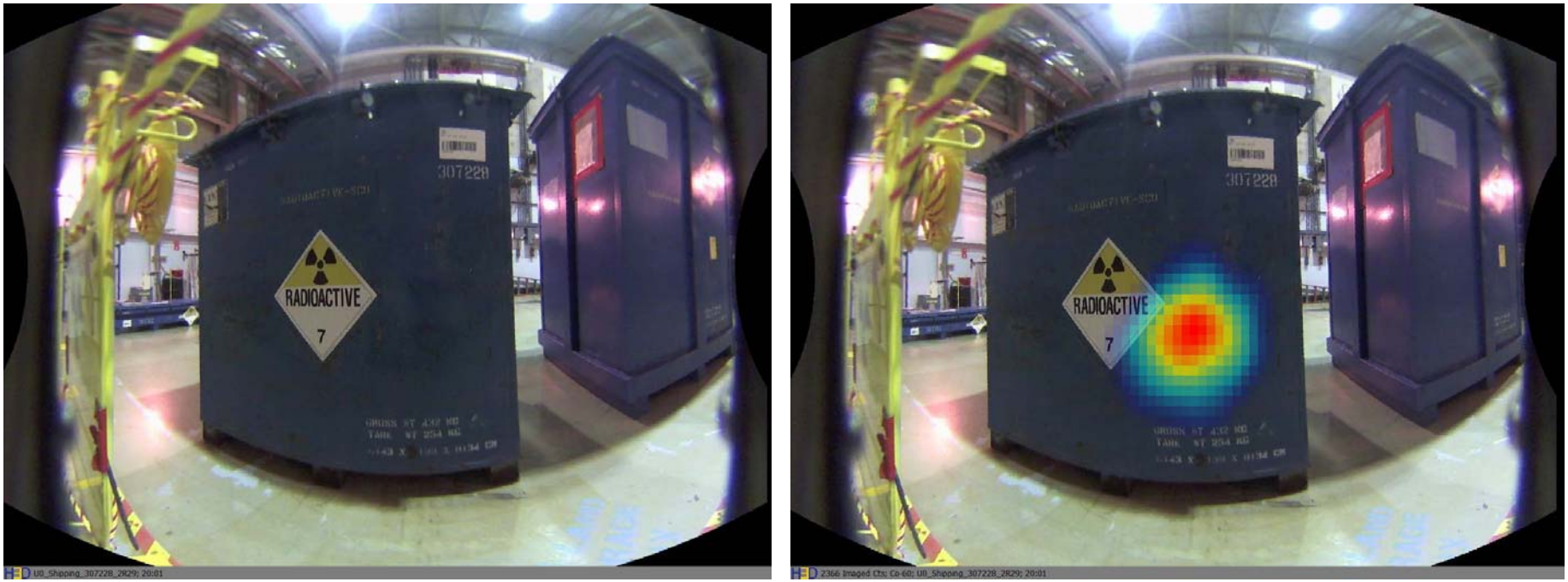
CZT IMAGING EXPERIENCE AT OTHER SITES

- Assigned a dedicated health physicist to manage the CZT measurement program at Prairie Island (PI)
- Sent individual to a Cook refueling outage to assist in imaging each level of the Aux bldg. and contaminated scaffolding
- Participated in the Palisades Fall 2015 refueling team and characterized a US PWR with high contamination levels

FALL 2015 PRAIRIE ISLAND REFUELING OUTAGE PLAN

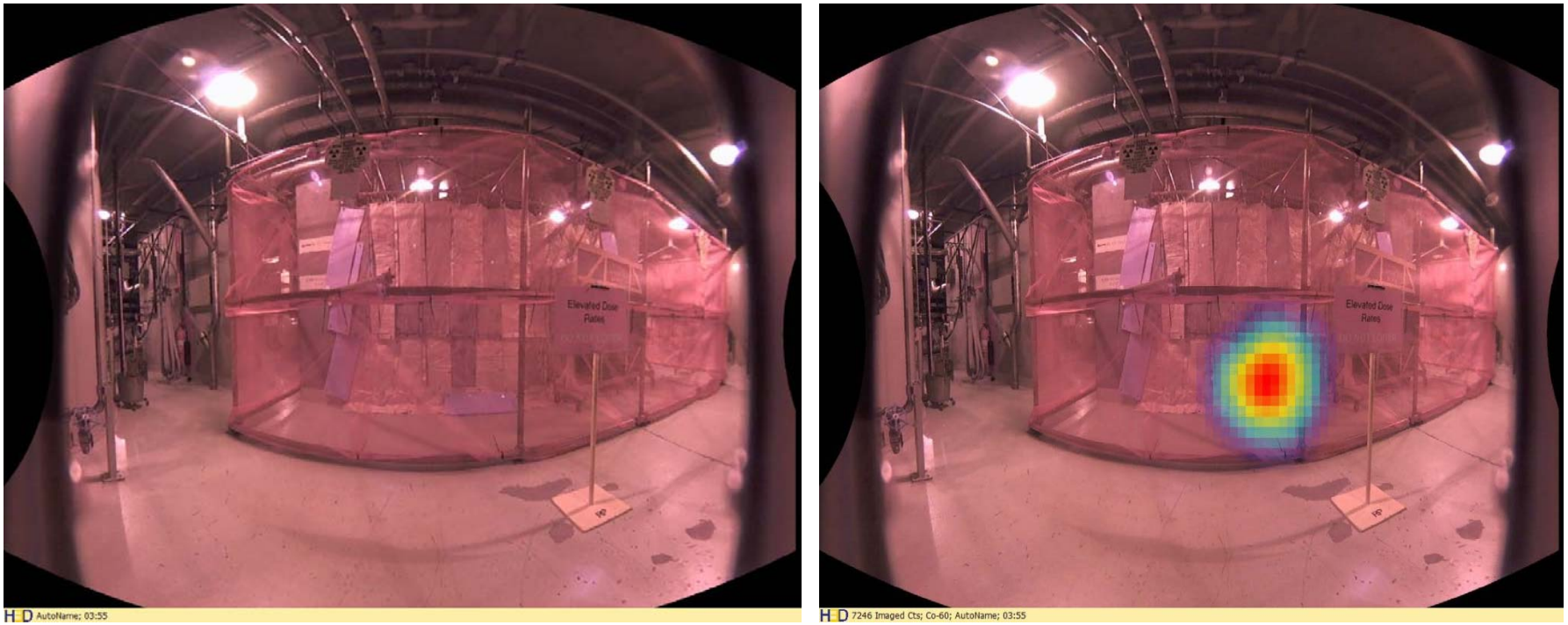
- PI developed a specific CZT imaging plan prior to the refueling outage based on the prior experience at PI and other PWRs
- Focus on looking for spread of contamination
- Surveillance on hot spot identification
- Temporary shielding adequacy
- Radioactive waste shipments

SHIPPING CONTAINERS



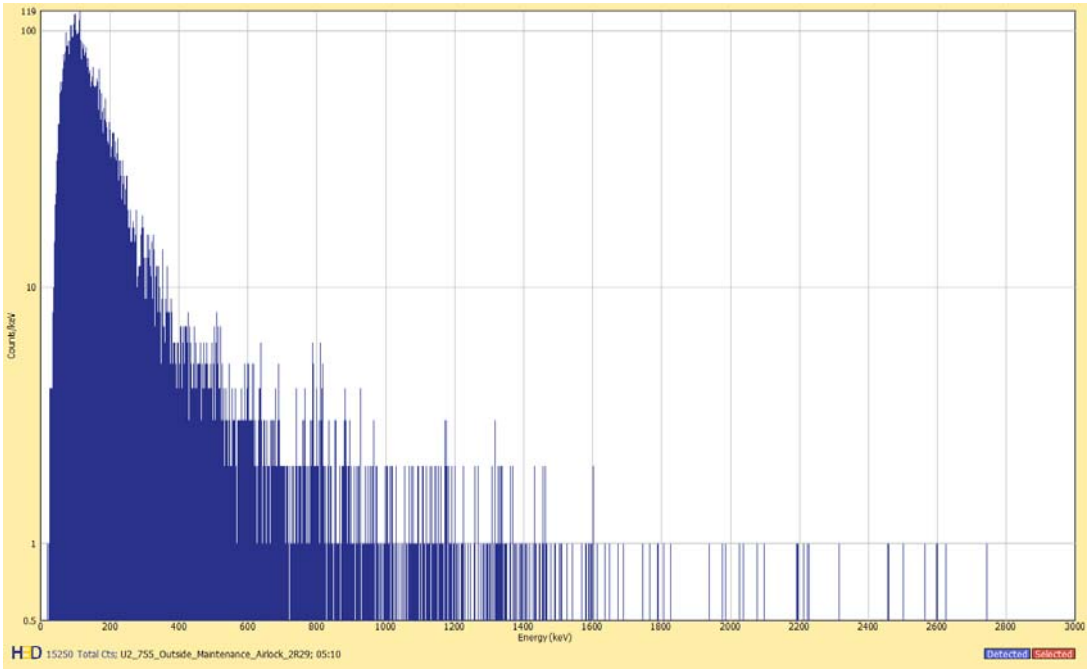
The image on the left shows the camera image of a Radioactive Material (RAM) shipping container. On the right, the image shows the area with the highest concentrated activity of Co-60.

SHIELDING VERIFICATION



The image on the left shows the camera image of the Sump C shielding package. On the right, the image shows the area with the highest concentrated activity of Co-60. There is no identified streaming in this image, and additional shielding was placed in the colored area.

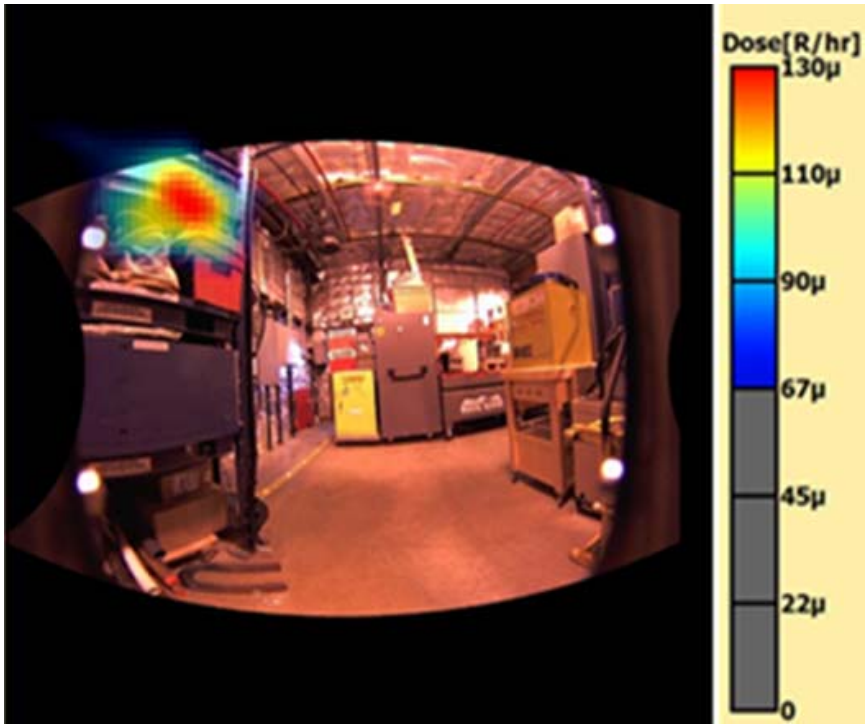
CONTAMINATION CONTROL

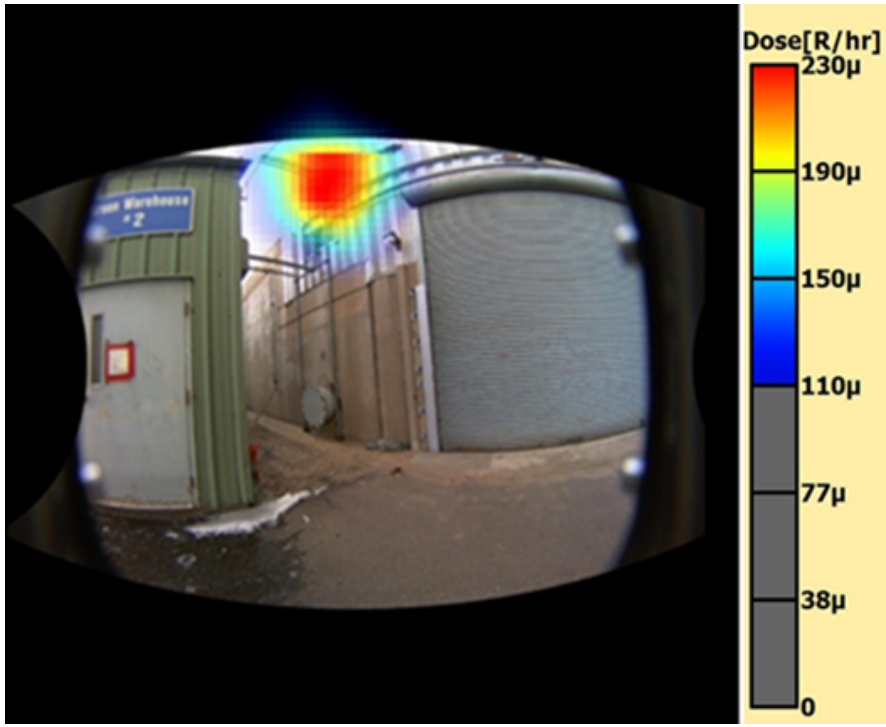


This image is outside of the Maintenance Airlock during the Unit 2 refueling outage. There was not enough data to create a radiation image, which indicates no hot particles or contamination were coming out of the Airlock. Coupled with surveys and the low number of Personnel Contamination Events, this shows a robust Contamination Control program during the refueling outage.

DOSE DISCREPANCIES

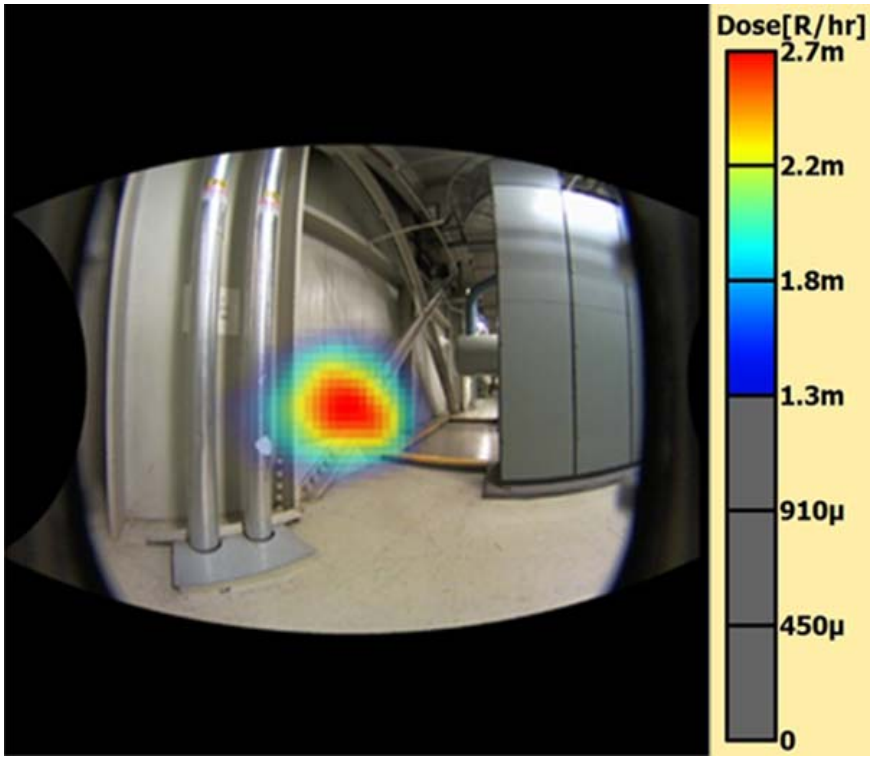
During the triannual ED/TLD dose comparison, discrepancies were noticed on individuals that spend most of their time working outside of the radiologically controlled area in a storage warehouse. The image on the left shows the inside of the warehouse, while the image on the right shows low intensity Co-60 shine from the radiological liquid waste processing building.

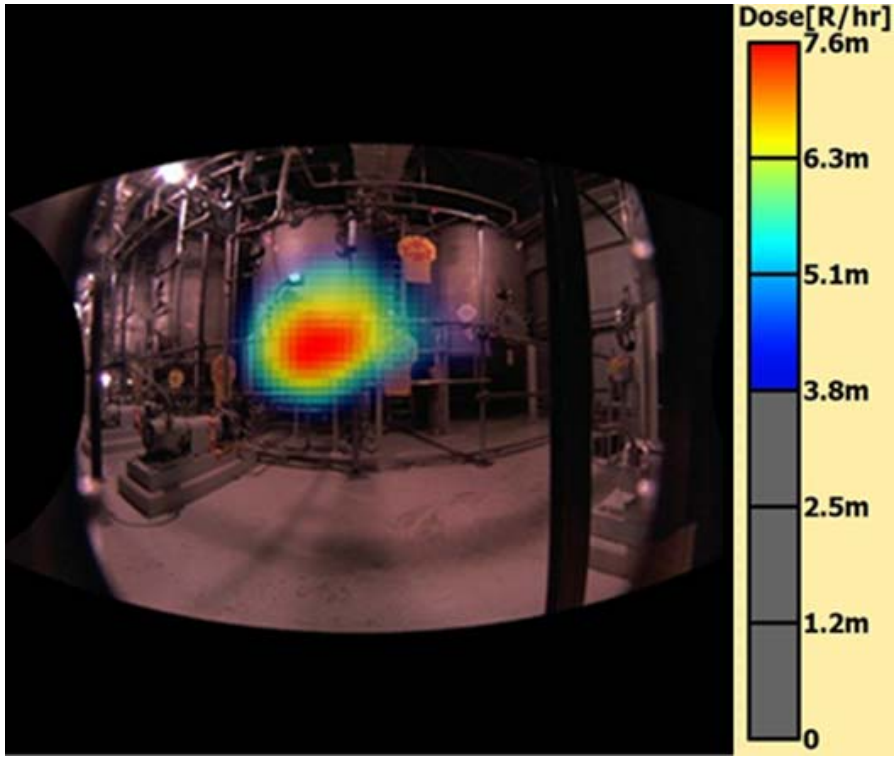




DOSE DISCREPANCIES

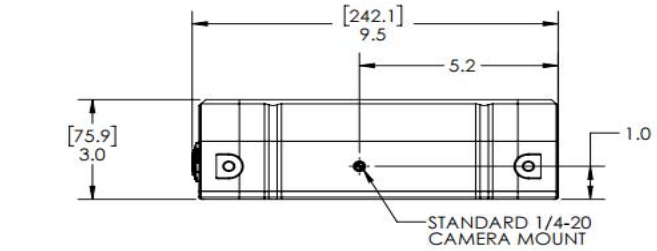
Two tanks in the Rad Waste building were identified as the source of shine. Work Requests were generated to flush the tanks to lower shine levels and environmental TLDs were placed inside of the warehouse to more closely monitor the area.

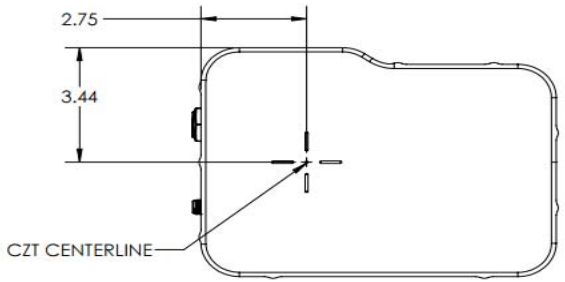


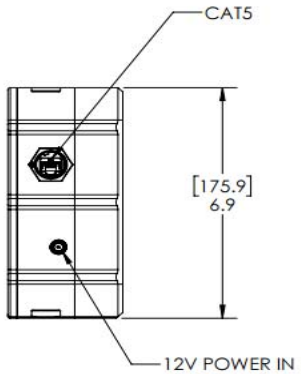


POLARIS-S
FUTURE PROJECTS

This is the prototype design for the Polaris-S system in development by H3D. The goal is to mount the Polaris-S on or near a pipe to act as a temporary rad monitor during an outage. This can be used to monitor the crud burst real time, allowing real time monitoring and a method to predict when clean-up can stop.



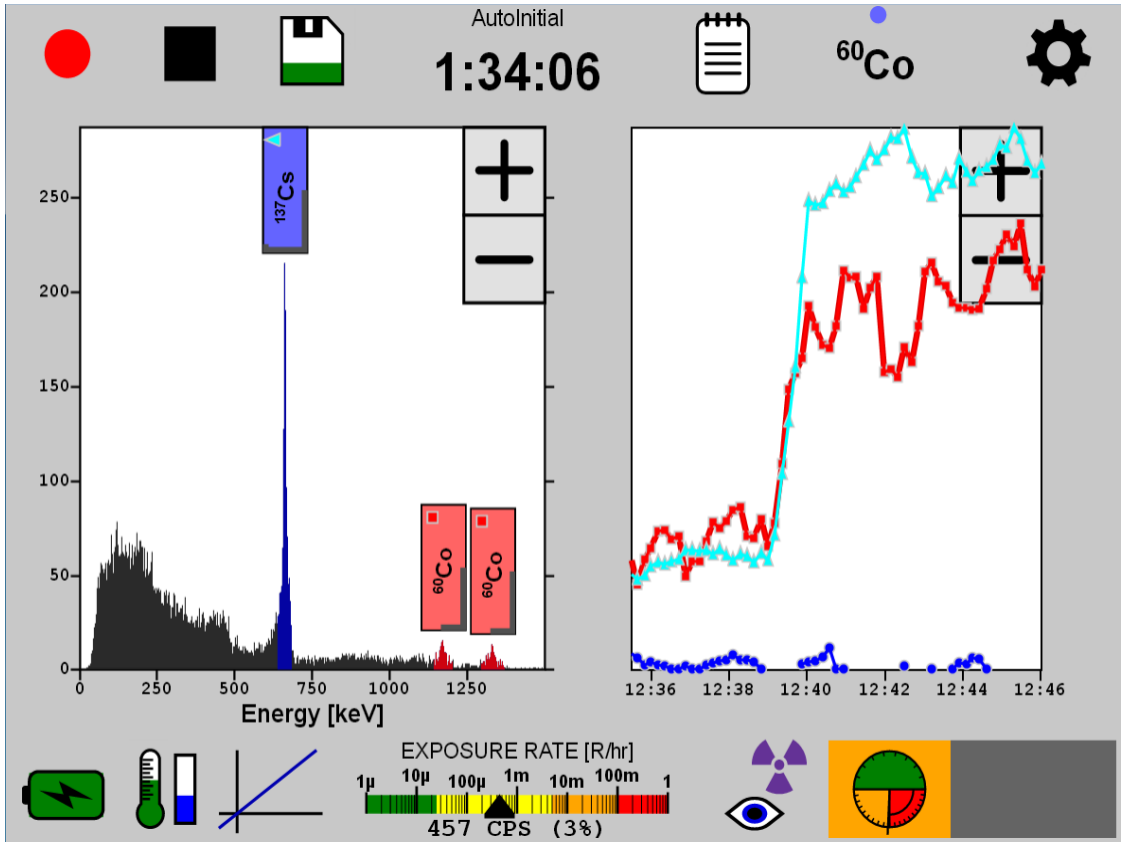




POLARIS-S CHARACTERISTICS

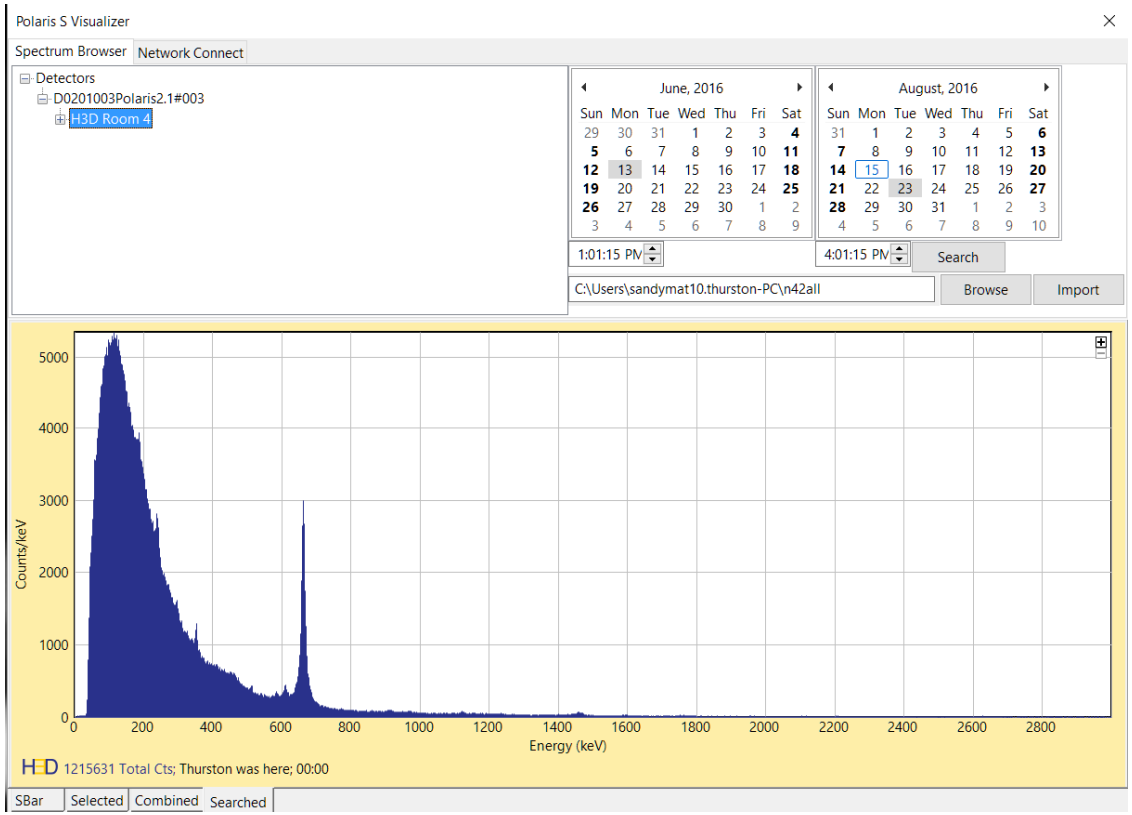
- ≤ 1.0% FWHM at 662 keV
- Energy range: 50 keV – 3 MeV
- Count Rate Sensitivity: natural background to 0.5 rem/hour bare Cs-137 source
- IP65
- Power Supply: 100-240V, 47-63 Hz
- Battery Life: >6 hours at 73°F, >3 hours at 5°F or 122°F
- Data storage on removable USB drive
- View real-time data on tablet or over network communication
- Data download via tablet or over network communication
- WiFi, Bluetooth and Ethernet compatible
- Post-processing software to analyze and compare results

POLARIS-S
REAL-TIME INTERFACE



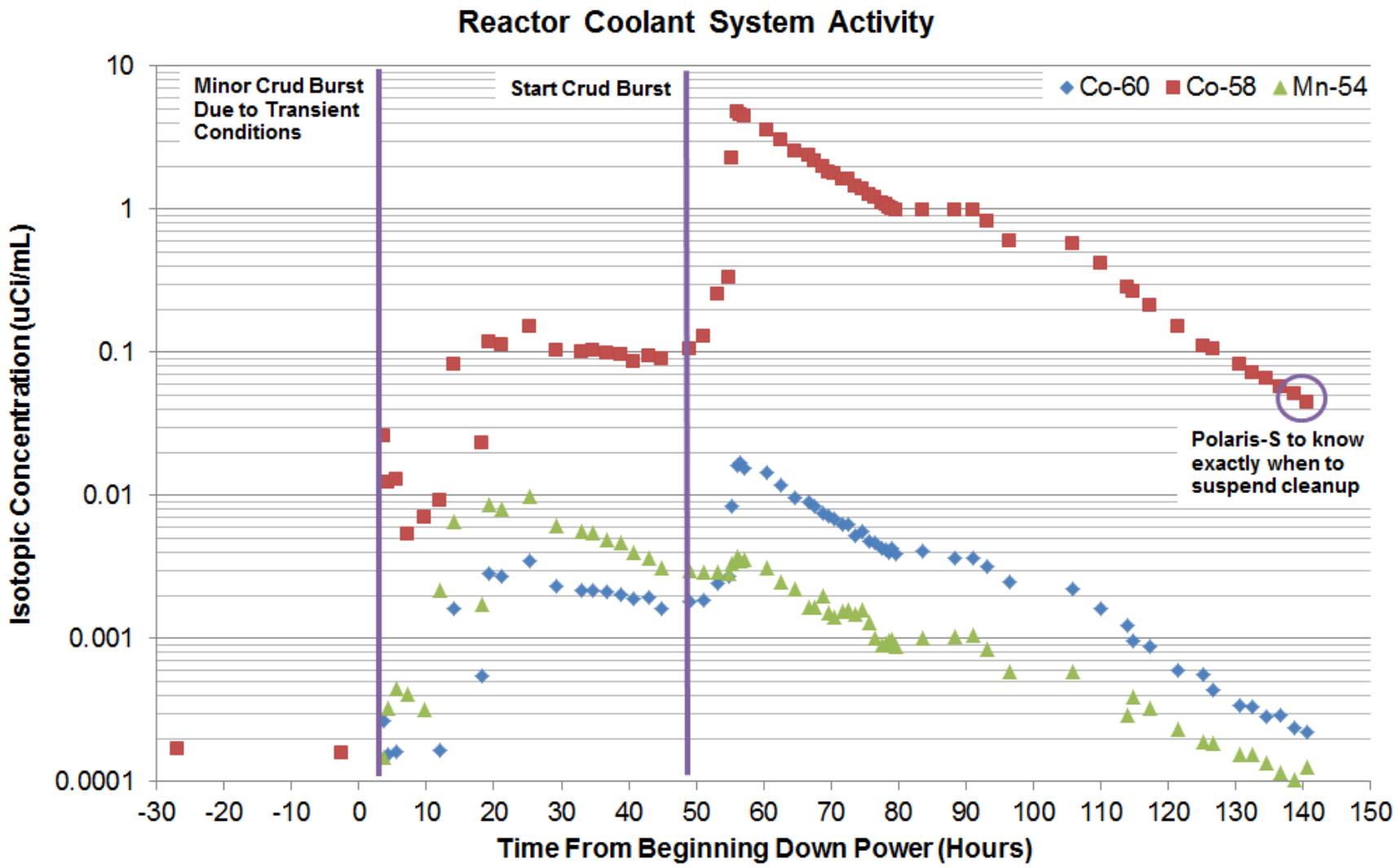
- Initially will provide dose rate ratios graph of the different isotopes
- Goal is to provide estimate of the isotopic concentrations within piping
- Can zoom in/out on either spectrum or graph (as well as make either full screen).
- Under settings can change system settings, such as the integration time for the dose ratios

POLARIS-S
POST-PROCESSING SOFTWARE



- Allows you to select data to analyze based on date/time, system and measurement location
- Preview collected spectra
- Performs Isotope Activity Analysis and exports data to Excel to analyze isotopic trends

POLARIS-S
CRUD BURST MONITORING



POLARIS-S
OUTAGE COST SAVINGS

Knowing exactly when the Reactor Coolant Systems reaches the cleanup goal could have saved roughly 2 hours of critical path time. Assuming an 18 month fuel cycle and a $1M outage cost per day, this would result in the following potential savings:

$83,333 Per Outage

$1,111,111 Over 20 Year License Extension

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QUESTIONS