

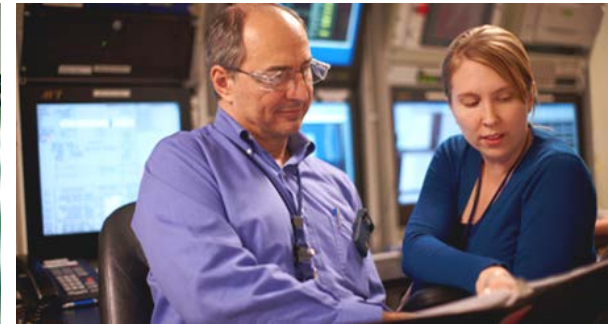
Pickering ALARA Program Highlights

Leveraging Technology for Dose Reduction

Karen McDougall
Section Manager, ALARA
Pickering Nuclear

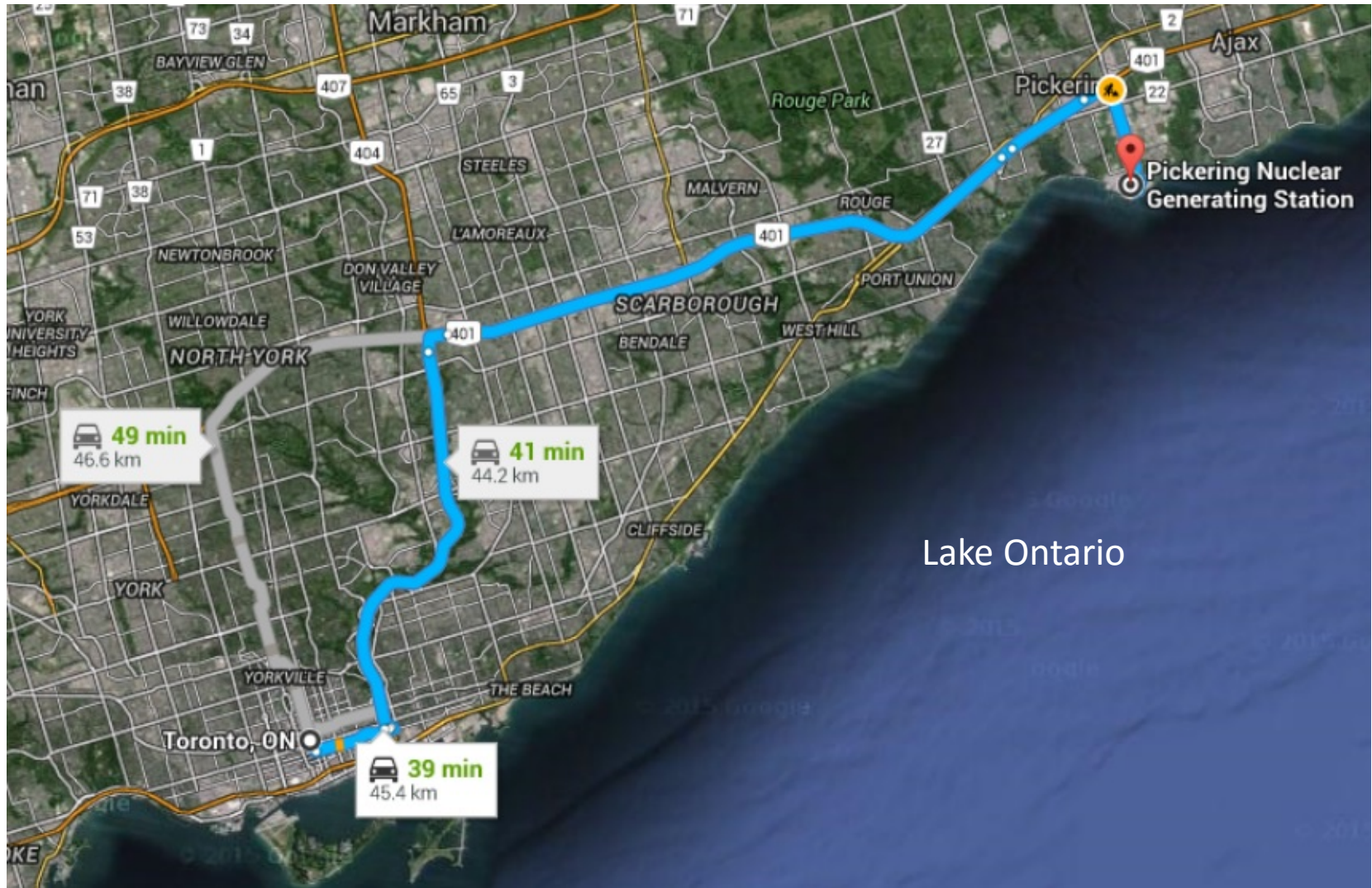
BEHAVIOURS

- Say It, Do It
- Simplify It
- Think Top and Bottom Line
- Integrate and Collaborate
- Tell It As It Is



VALUES ▪ SAFETY ▪ INTEGRITY ▪ EXCELLENCE ▪ PEOPLE & CITIZENSHIP ▪

Pickering Nuclear

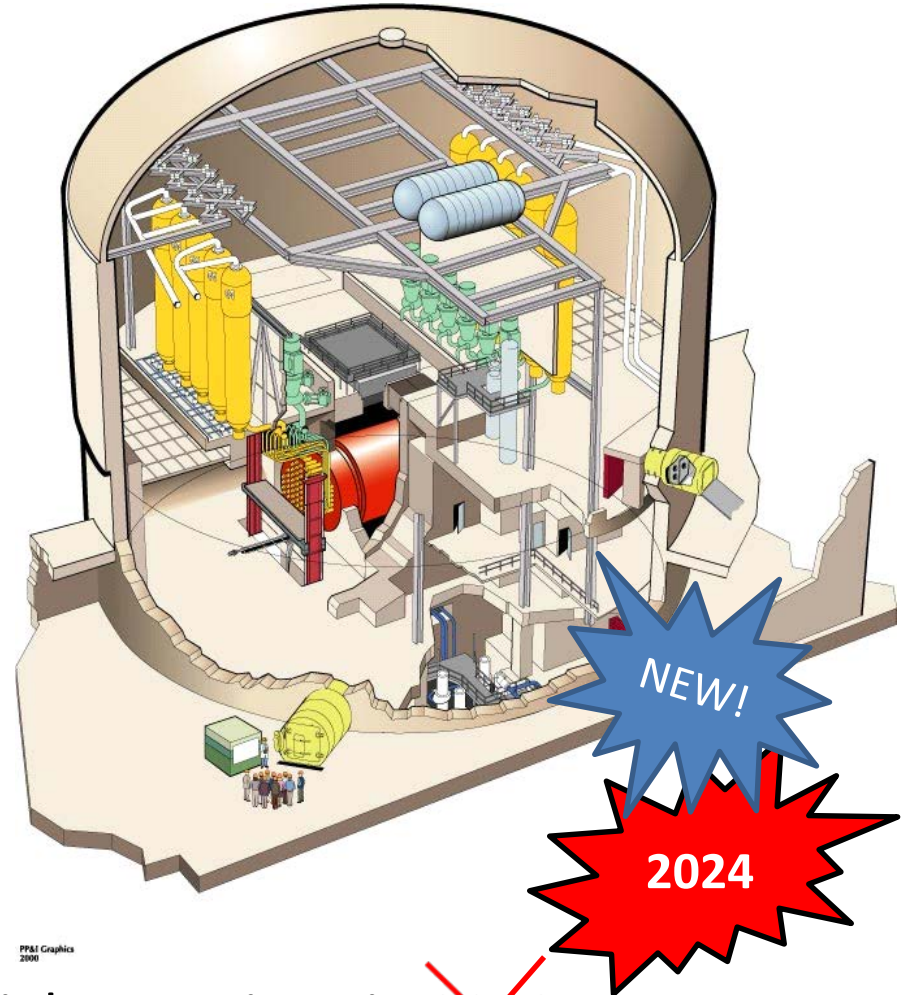


Pickering Nuclear





- Pickering Units 1 – 4
 - 540 MWe, 390 channels
 - In service 1971 – 1973
 - Units 2 and 3 in Safe Storage since 1998
- Pickering Units 5 – 8
 - 542 MWe, 380 channels
 - In service 1983 – 1986
- On power refuelling
- Self-protection & service protection RP model



Pickering will cease commercial operations in ~~2020~~





Qualified workers are sometimes not performing fundamental RP Practices properly.

Contributing to this is that leaders are not reinforcing and correcting required radiological control standards and expectations.



We Are ALL RP



At Pickering, we have a sound Radiation Protection Program. But achieving excellence in RP requires more. It takes a culture of strong line management ownership of the RP behaviours of all staff.

By holding each other accountable, station leaders and workers will be aligned to minimize dose, reduce source term and implement controls for radioactive contamination. We work in a unique industry with a unique hazard. Demonstrating excellence means that we're 'all RP Managers'.

I am committed to excellence in radiation protection.



Why Don't Leaders Coach RP?



- DLA For Operators – Managing Tritiated Process Fluids
- DLA for Maintenance Staff – Controlling Contamination
- DLA for RP Staff – Managing High Radiation Areas

Staff feedback – they loved it!

- But... what about station leadership?
- Performance gap led us to deliver DLA for Managers – What Good Looks Like





Perform coaching and observation of RP fundamental behaviours in accordance with station procedures and management expectations during oversight of a simulated radioactive work assignment

Improve supervisory oversight with focus on radiological risk and consequences





- A review of selected gaps in RP performance at Pickering
- A review of OPEX with a focus on risk and consequence
- A demonstration of opportunities for coaching and commendation of RP fundamentals through videos
- Use of technology and 'actors' to provide opportunities for the participants to practice the coaching skills



OPEX - Risk & Consequence



SCR No : P-2013-03132

SCR Date/Time 2013/03/07 13:25

SCR Status CLOSED

Event Title Waste bag found in rad hazard sign posted area

Discovery Date 2013/03/07

Location

Date/Time Occured 2013/03/07 10:00

Facility P

Power

Unit 4

Equipment Failure N

Equipment Tag	Crit Cd
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Vendor Related N

Vendor	Suffix
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Opex Communication To External Internal WANO N Fleetwide N COG N N/A N N/A N

Condition Description and How Discovered Waste bag found in AL 3 - Unit 4. The rad hazard sign did not indicate that there were any hazards present. As found gamma fields were - 160 mrem/h contact and 15 mrem/h working distance. No rad hazard tag (N-FORM-10076) was affixed to waste bag indicating hazard.

Immediate Action Taken Attached rad hazard tag 10076 indicating levels within and brought waste bag to active waste.

Risk & Consequence:

- Could have resulted in the unplanned exposure of a worker
- Could have been CNSC Reportable – risk to the Power Reactor Operating Licence

Notification Criteria

If Different than Initial Reportability Why? 2013/03/11 Per Reg Affairs - Not Reportable - There are no RPR violations, no programmatic deficiencies, nor safety significant RP events; no S99 reportable RP events.

Affects Operability N TOE Required TOE Status

Operability Comments

Resolution Category D NFE N Significance Level 4

Rationale for Resolution Category Disposition Action taken, condition trended, or condition addressed outside the SCR process. This was procedural non-compliance, for not posting the highest dose rate. Location was within a signed and posted area.



OPEX - Risk & Consequence



SCR No : P-2012-18502

SCR Date/Time	2012/11/17 18:29	SCR Status	CLOSED
Event Title	P1211 - Worker Exited Boiler Room with Facial Contamination		
Discovery Date	2012/11/12	Location	U1 '317 A/L 5 Rubber Area Exit
Date/Time Occured	2012/11/12 12:30	Facility	P
Power	0	Unit	1
Equipment Failure	N	Equipment Tag	Crit Cd
Vendor Related	N	Vendor	Suffix
Opex Communication To	External Internal	WANO N Fleetwide N	COG N N/A N
Condition Description and How Discovered	A worker was exiting the U1 Boiler Room and was contaminated in the facial area after making a head entry into boiler #2. Upon further inspection there were 500cpm loose found under the workers chin, 200cpm loose found in the workers mouth area, 3000 to 4000 cpm spread all over their brown coveralls and 6000cpm on both forearms due to coverall sleeves being rolled-up.		

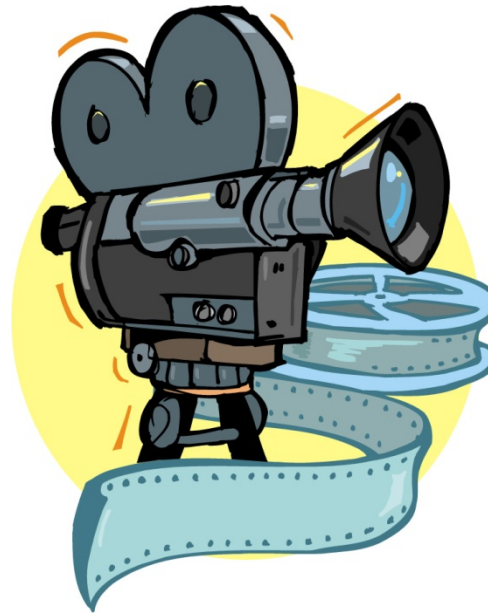
Risk & Consequence:

- Safety risk to worker – potential significant unplanned dose
 - Fecal sampling initiated for three months
 - Worker on radioactive work restrictions for one year
 - Fear and anxiety for worker and their family
- Potential regulatory dose exceedance
- Risk to our Power Reactor Operating Licence





- Can you find an opportunity to commend or coach?



Would you have coached? >>



- Comfo respirator was not placed in proper receptacle
- Worker's RPPE sleeves of were rolled up inside Rubber Area
- EPD was not worn on outside of Anti Cs
- Handled Anti Cs without use of rubber gloves
- Anti Cs improperly placed in bins, crossed Rubber Area boundary
- Liquid placed in solid active waste stream
- Waste bag not 'goosenecked'
- Removed booties without wearing rubber gloves
- Active waste not monitored before leaving area
- Worker reached outside of rubber area boundary



- Can you find an opportunity to commend or coach?



Would you have coached?



- Person was not clean shaven
- Had worker been clean shaven, Comfo was worn improperly
- Air hose placed on floor, then on table, increasing potential to spread contamination within rubber area
- EPD was not worn on outside of Anti Cs
- Worker demonstrates poor practices while in R/A and while undressing, increasing the likelihood of a PCE
 - Handles Anti Cs and equipment with out use of rubber gloves
 - Wipes face with potentially contaminated hand.
 - Removes booties with no rubber gloves on.
- Air hose not contained before worker left the rubber area

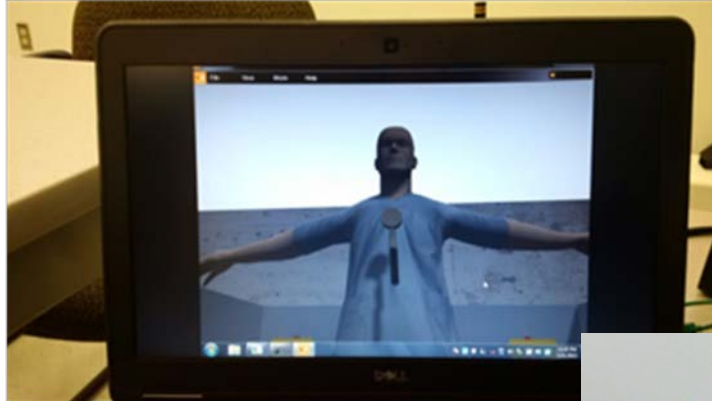




- So... we've told the managers about OPEX events that have occurred at Pickering, and the associated risk and consequences
- We've shown them examples of opportunities to coach that are based on fundamentals
- Now... it's their opportunity to put this into practice
 - Using actors, the managers are now 'in the field' and have an opportunity to put what they've seen and heard into practice by observing a 'simulated' radioactive work activity



DLA - Technology



What Did We Learn?



- Simple review of fundamentals and common sense in a non-training environment gave managers the confidence to coach on RP practices
- We followed the DLA with a paired coaching opportunity with a member of the RP Department, in the field similar to that in the scenario – saw and heard evidence of effectiveness
- We need to continue to develop DLAs
 - We just completed a DLA on tritium dose management - we learned that the 'simple tritium exposure planning tool' wasn't that simple. The tool has been changed as a result of stakeholder feedback
 - This has been one of our best years for internal dose management
- Next up – DLA on dose goals - making every mrem count

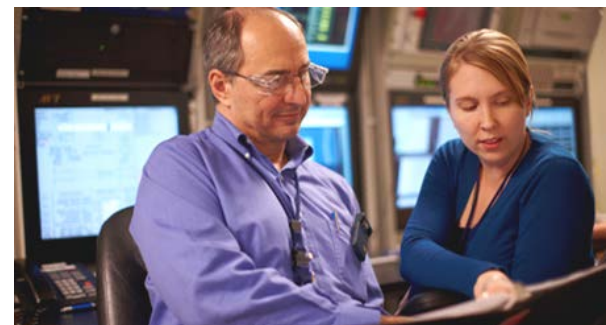


Pickering 1-8 Dose Reduction Strategy Utilizing Robotics 1 Year later

Dave McAlpine
Pickering Operations

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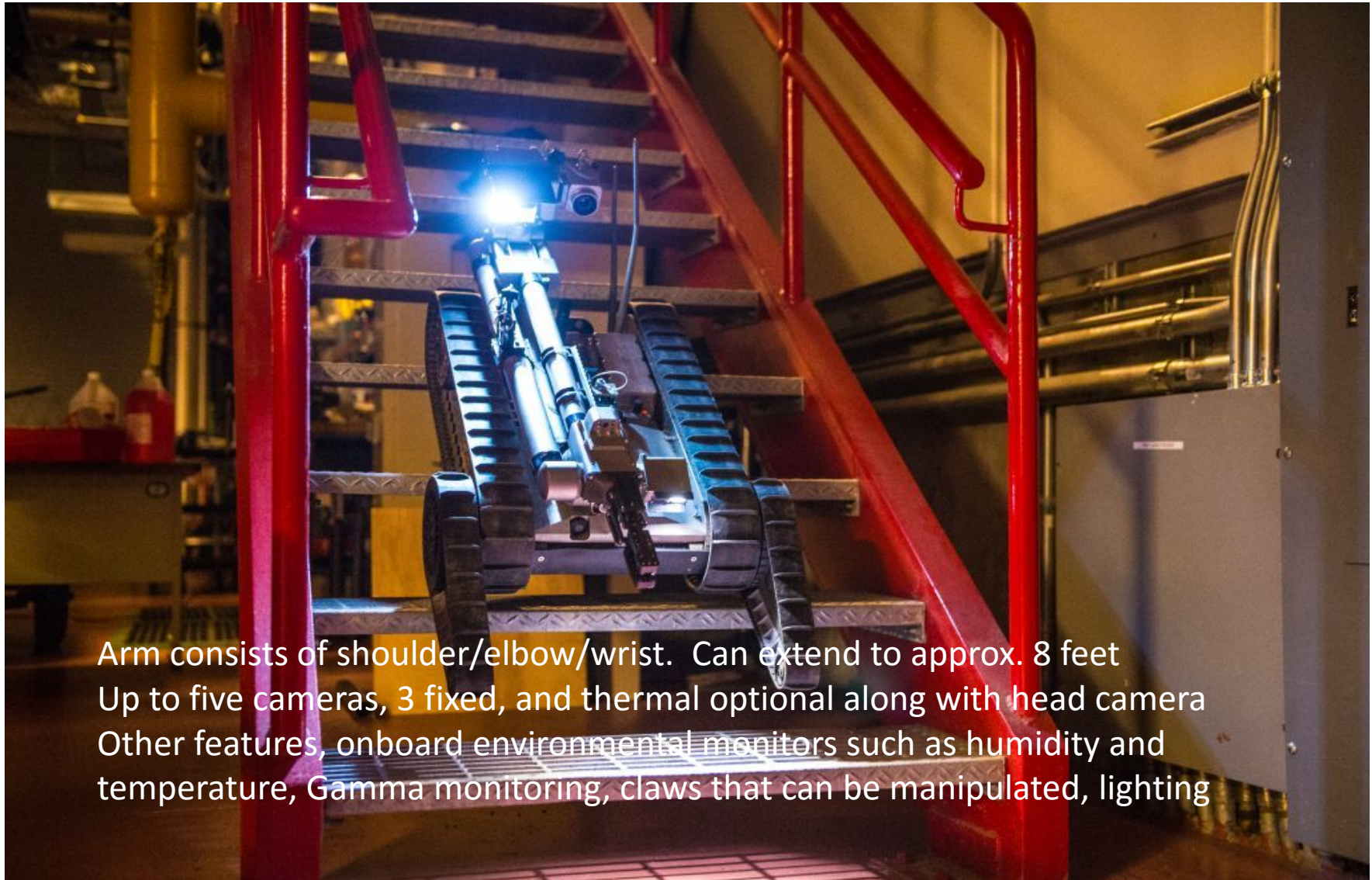
The Challenge



- Reduce Operations IOP dose to meet SAC approved target
- Focused on dose resulting from On Power Reactor Building entries
- Primary objectives of on power entries:
 - Leak search for D2O/H2O contributors to stack losses
 - Equipment monitoring/inspections related to degradation of equipment and future job planning
 - Dose mapping strategies for personnel entering medium/high hazard areas
 - Improve monitoring of plant
- What we (Operations) did:
 - Purchased iRobot PackBot 510 (x2) and First Look 110
 - Utilized the robots in high gamma/neutron/tritium environments, including areas where access is prohibited at power



iRobot PackBot 510



Arm consists of shoulder/elbow/wrist. Can extend to approx. 8 feet
Up to five cameras, 3 fixed, and thermal optional along with head camera
Other features, onboard environmental monitors such as humidity and temperature, Gamma monitoring, claws that can be manipulated, lighting



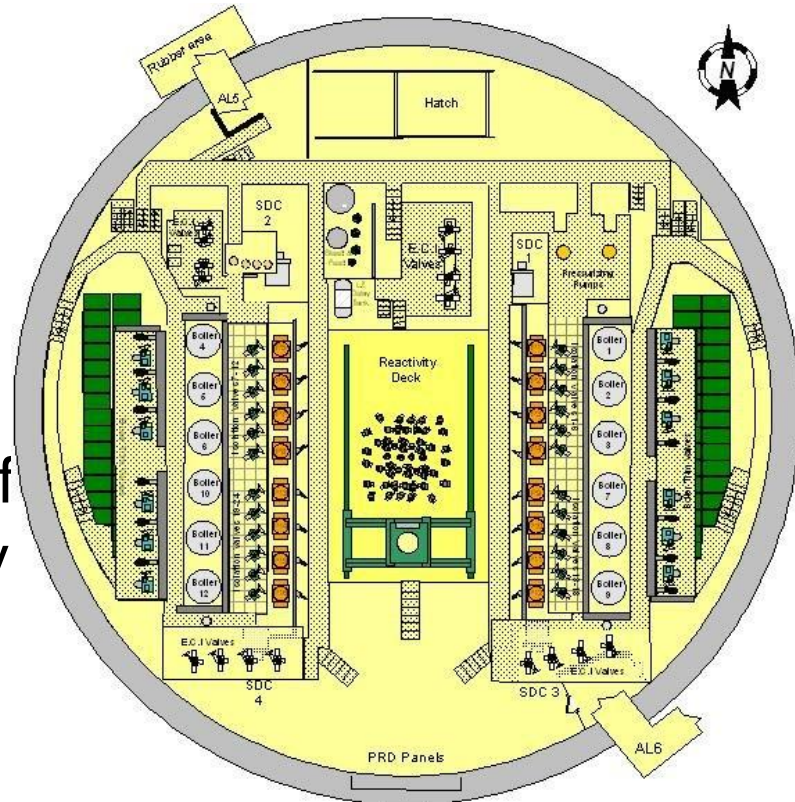


- A two Operator team operates the robot from a low dose area in plastic suits, usually under a low hazard REP
- Pickering 1-4 has trained and qualified 12 NLOs to operate the robotic equipment.
- Able to observe and inspect Access Controlled areas for prolonged periods of time producing more consistent and reliable information
- Robots were assigned a DISN for dose tracking purposes
- Robots are able to monitor gamma dose rates and perform other functions to meet the objectives





- Bleed Condenser check valve D2O leak contributing to elevated stack losses
- Leak location identified by PackBot
- Dose mapping strategy created for Maintenance staff to perform an on power entry to establish collection system.



1-33120-NV112 Component USI



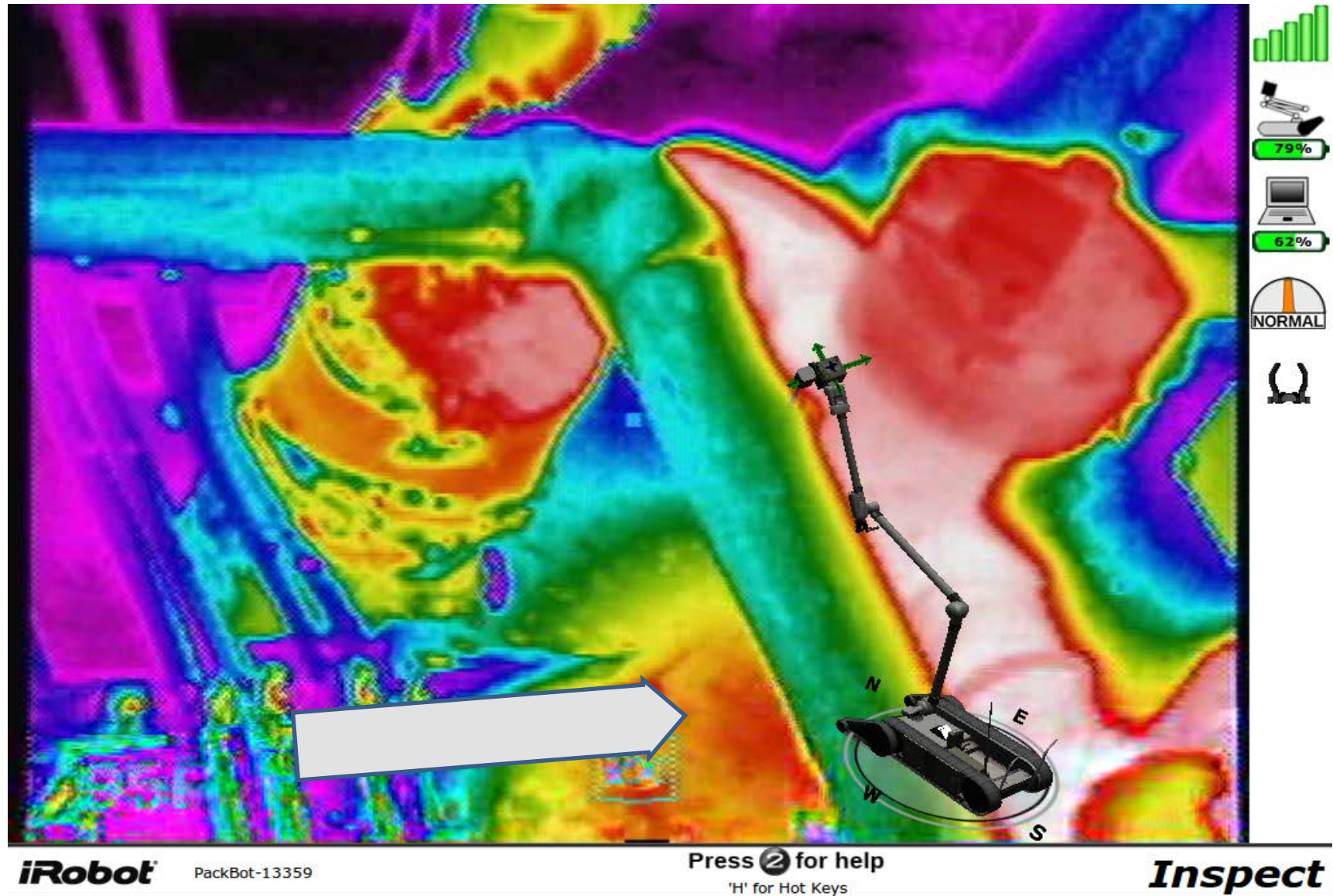
iRobot PackBot-13359

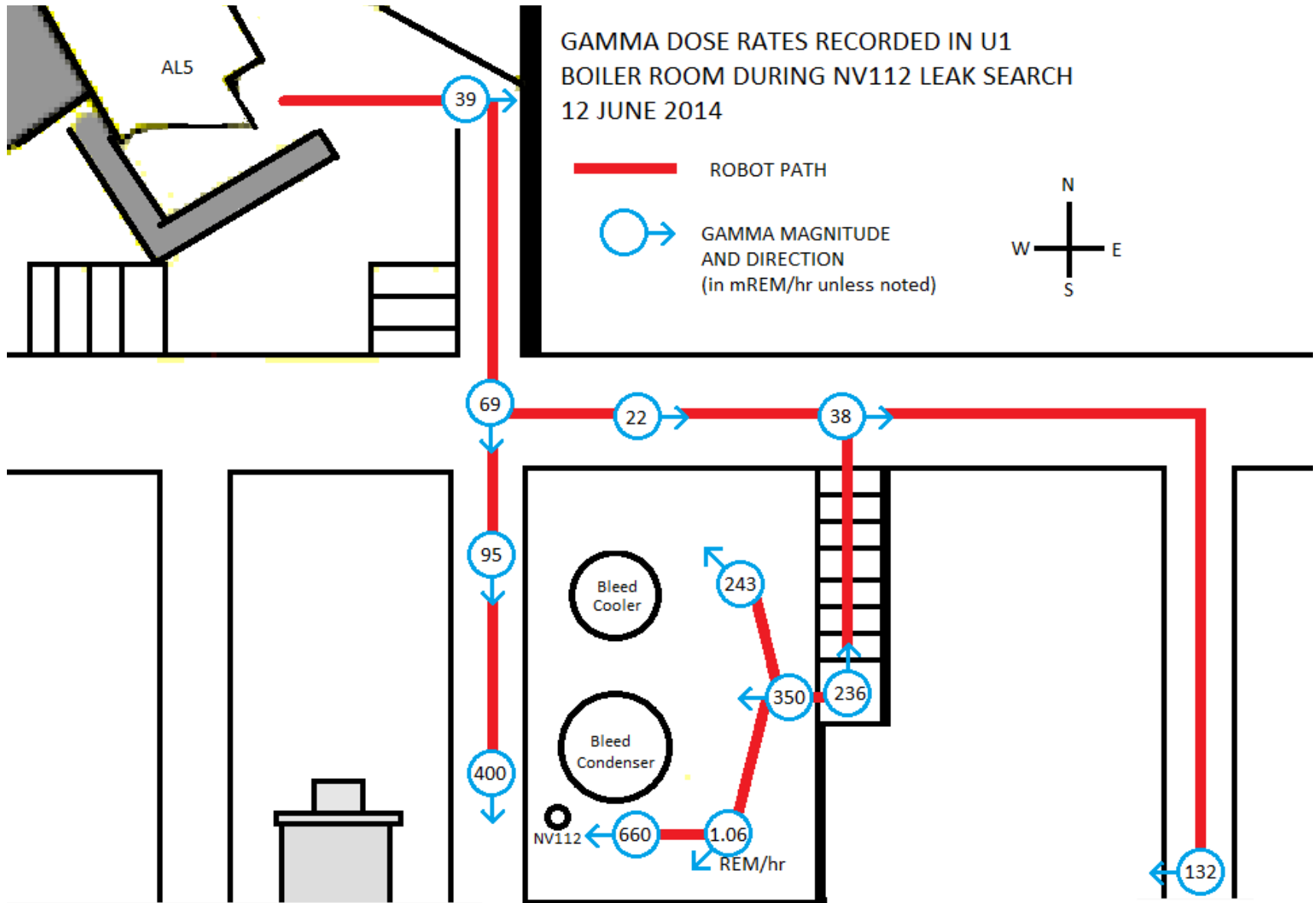
Press **2** for help
'H' for Hot Keys

Inspect



1-33120-NV112 Thermal Image







- Upper bearing oil leak with no Main Control Room annunciation available for low oil level
- In the past, multiple entries were made to monitor oil levels
- Ongoing entries would be required to support continued unit operation until next planned outage in 2016





4-33120-PM8 Upper Oil Level Comparison

06
N
O
V



14
N
O
V



26
N
O
V



13
D
E
C



04
J
A
N



17
J
A
N



03
F
E
B



11
M
A
R



19
A
P
R



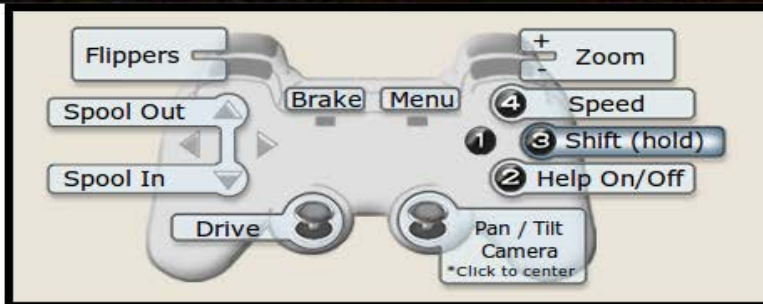
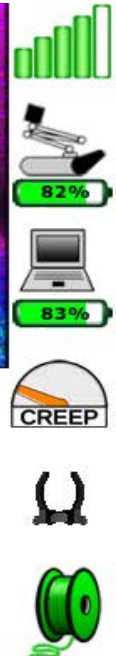
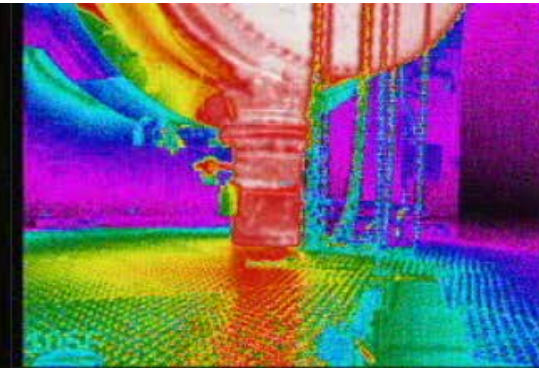
Suspected U4 Moderator HX Leak



- Unit 4 moderator room access controlled entry at 100% full power
 - Completed via Moderator Purification room access door to Mod Room
 - First time the Moderator Room was accessed for inspection at 100% full power ever
 - Highest gamma and neutron environment PackBot has ever worked in wirelessly
 - Robot total Dose = 6347 mrem gamma
 - Robot peak dose during entry 21.4 rem/h
 - Ops dose = 2.1 mrem gamma



Unit 4 Moderator HX1



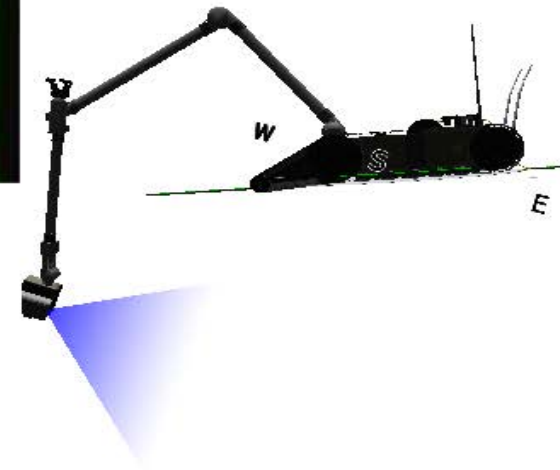
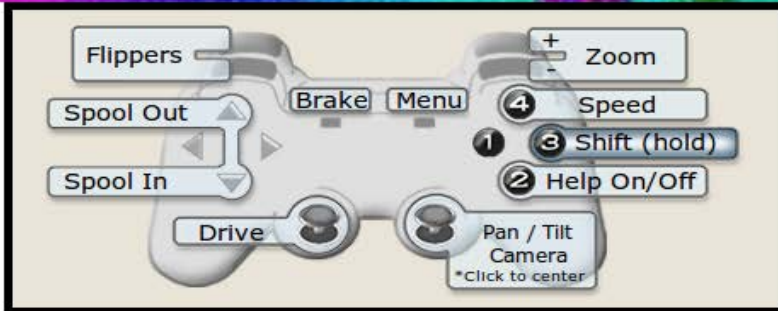
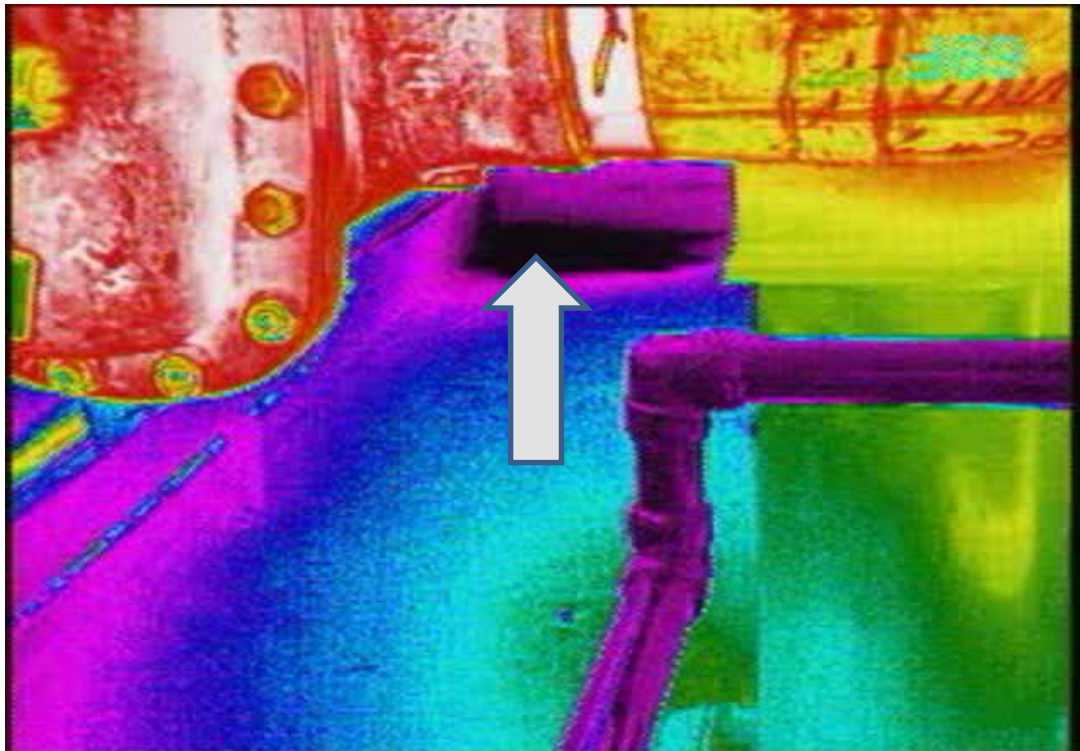
iRobot

PackBot-13359

Drive



D2O located under platform (black)



iRobot

PackBot-13359

OPG INTERNAL USE ONLY



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Drive

**ONTARIO POWER
GENERATION**

Operations Initiative Summary



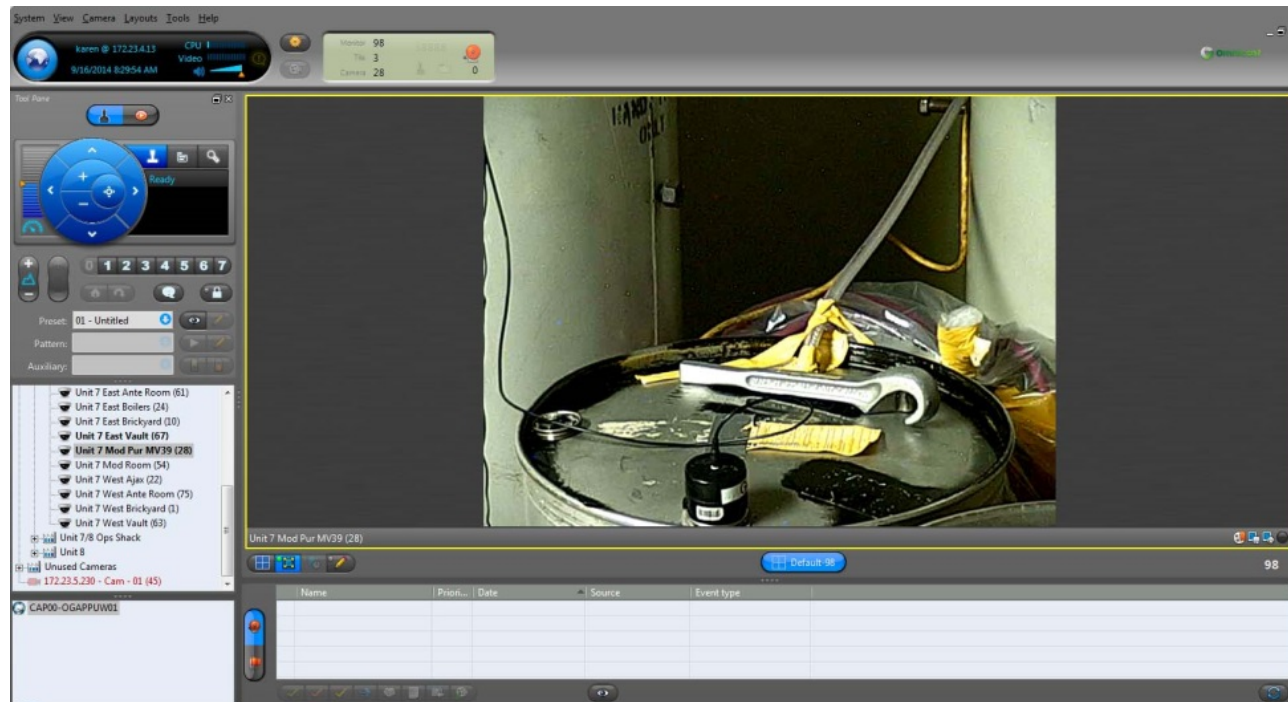
- 16 Access Controlled On Power entries completed using robots
 - 15 Boiler Room entries and one Moderator Room entry.
- Cumulative Dose totals for all of these entries:
 - Robot -12,441 mrem
 - Operators - 35 mrem
 - ***Approximately 1 mrem per Operator per entry!***
- Traditionally, on power entries range from 50 – 300 mrem per entry (external dose)
- Total inspection time in Access Controlled areas - 19.5 h
- We are RP!!!

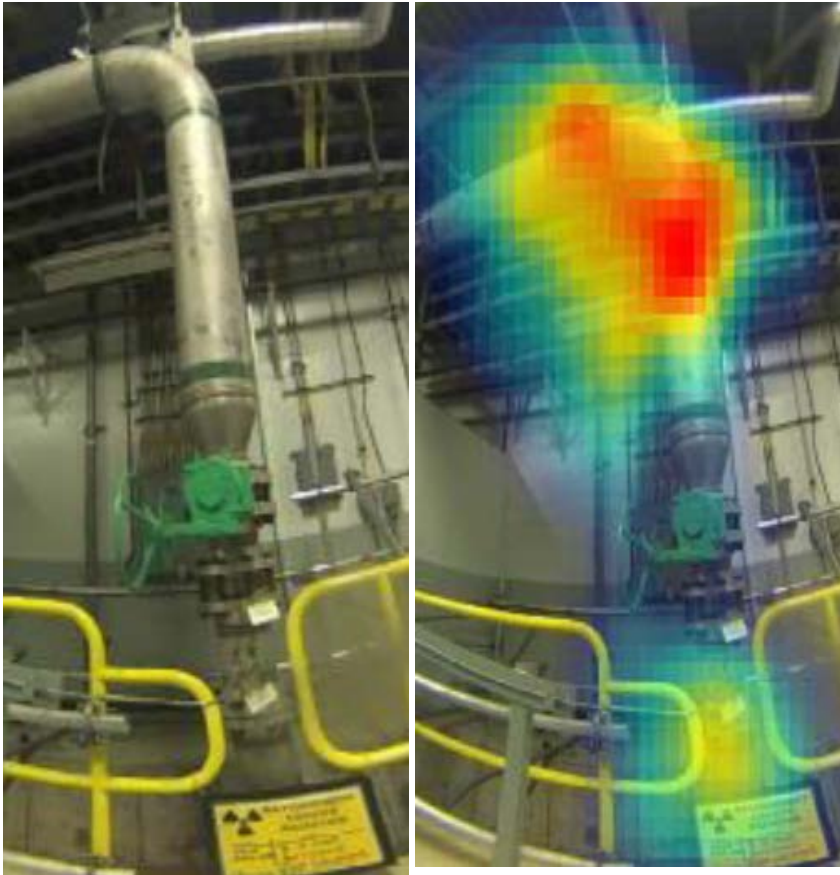


Teledose Enhancements



- Modified iCAMs to transmit data in real time
- ARMs on ET Vacuums to enable Civil Maintenance staff to manage their dose
- Developed remote level indication for D2O drums and remote power verification for ET Vacuums





- WBM out of service
- Attempts to shield detectors unsuccessful
- Scan identified plugged IFB filter
- Filter changed, WBM returned to service just prior to a unit outage



Questions?

