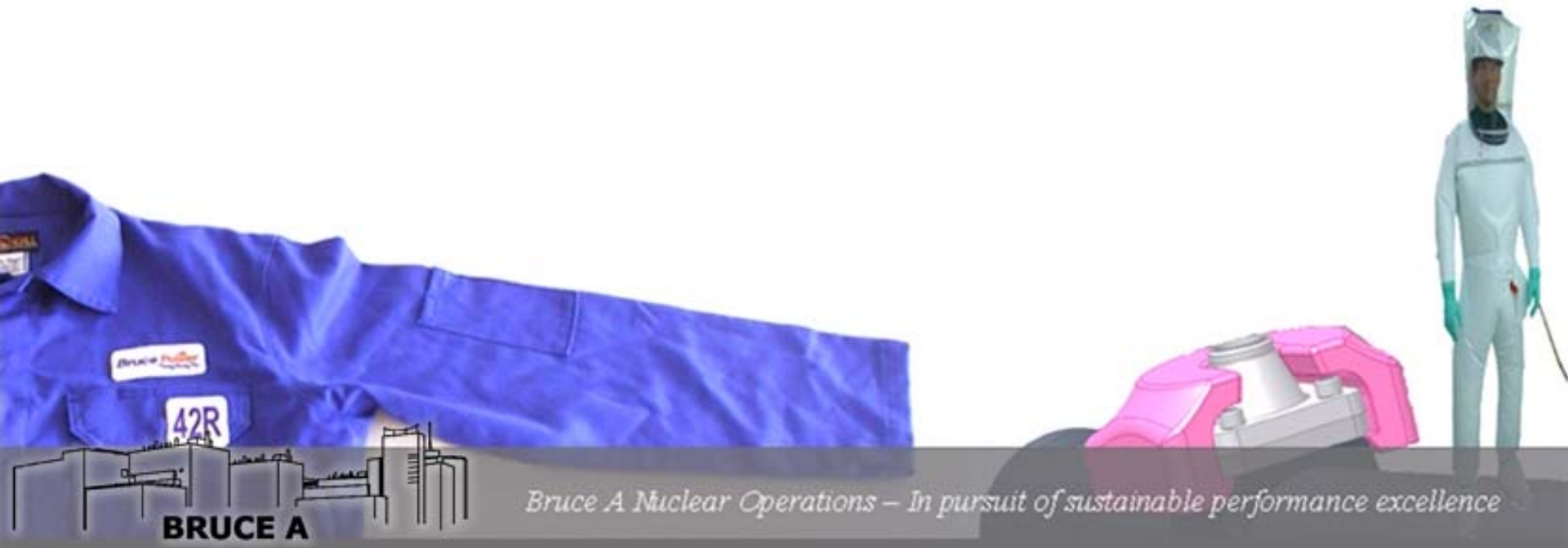


# Bruce A Successes in Internal Dose Reduction

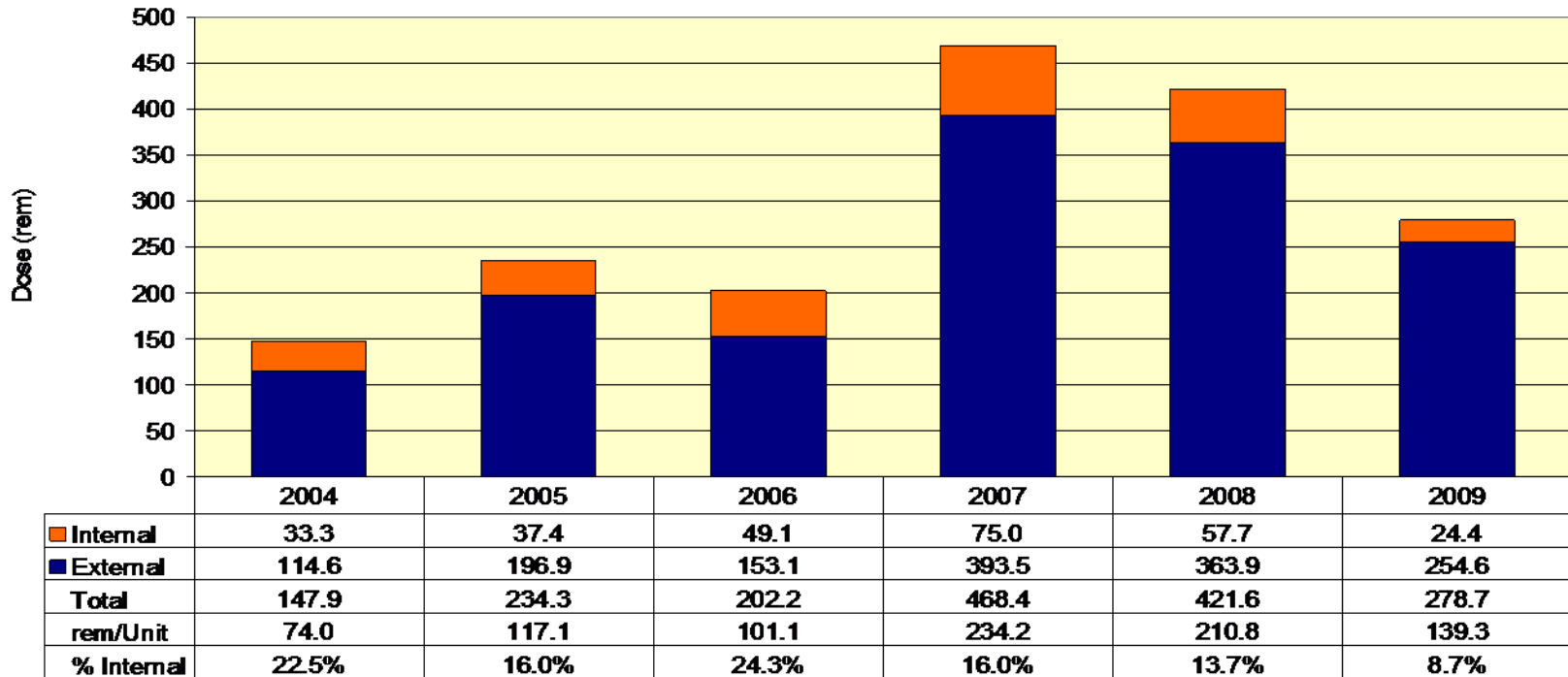
Presented by Mike Murray

Health Physicist, Bruce A Radiation Protection & Industrial Safety Department



# Bruce A Historical Performance

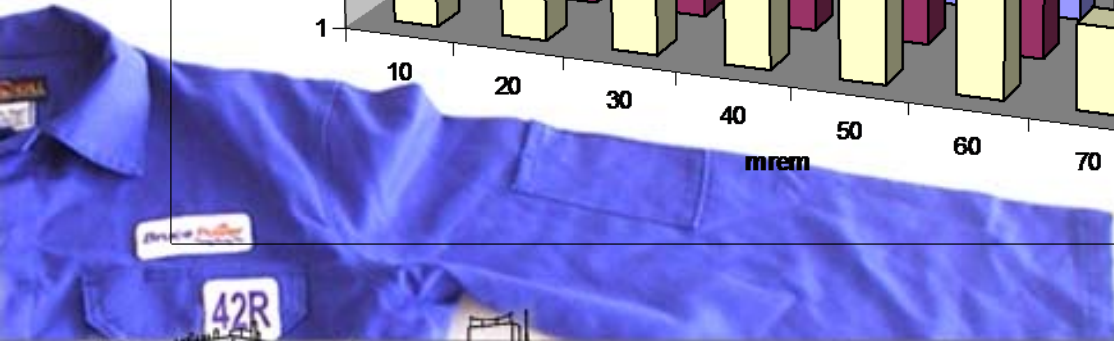
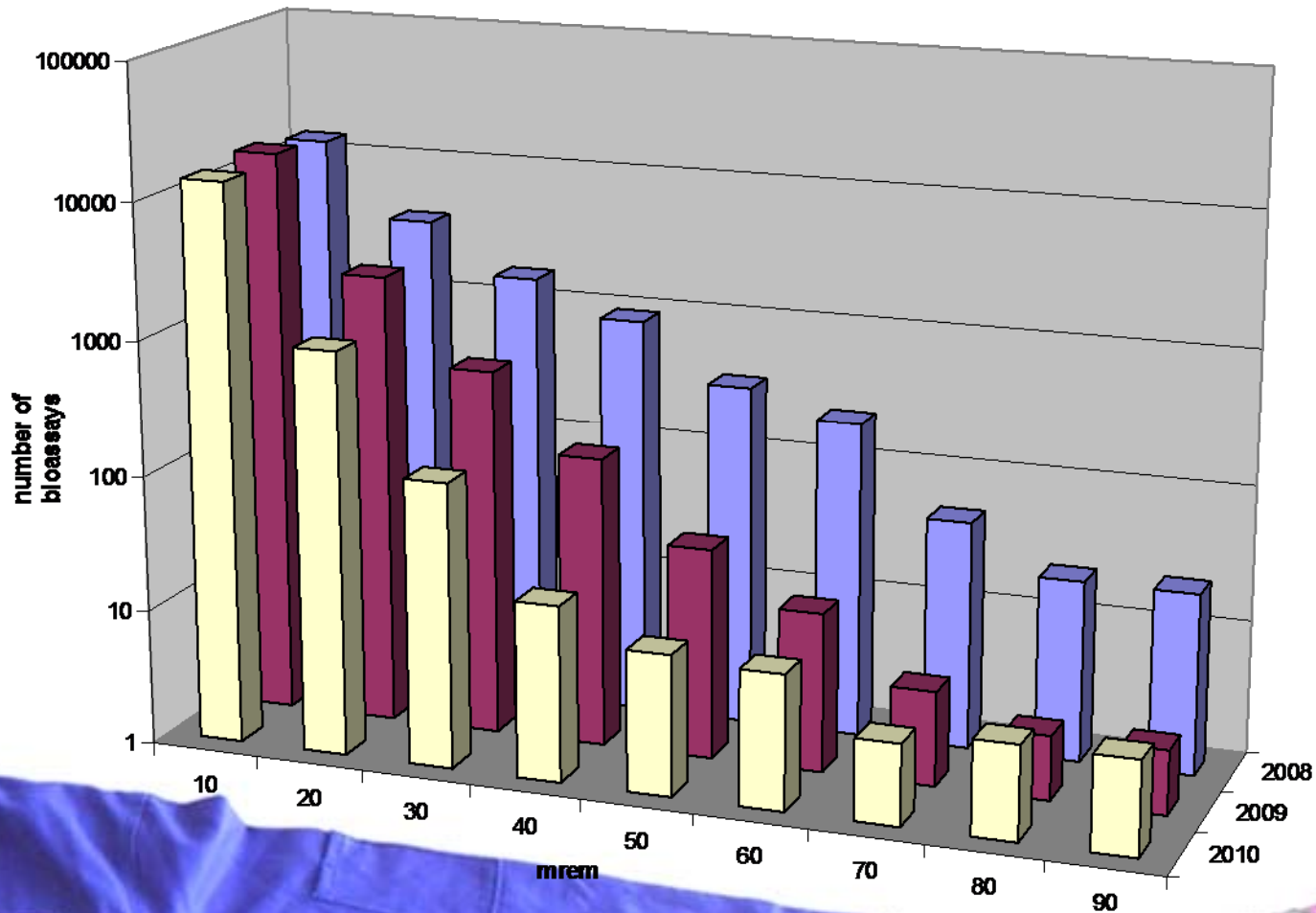
**Graph 1. Bruce A Dose Performance (Rem)**



- Current year to date performance = 4.5% as of July 2010
- Outage performance = 2%



### Bruce A Individual Bioassay Sample Results



**BRUCE A**

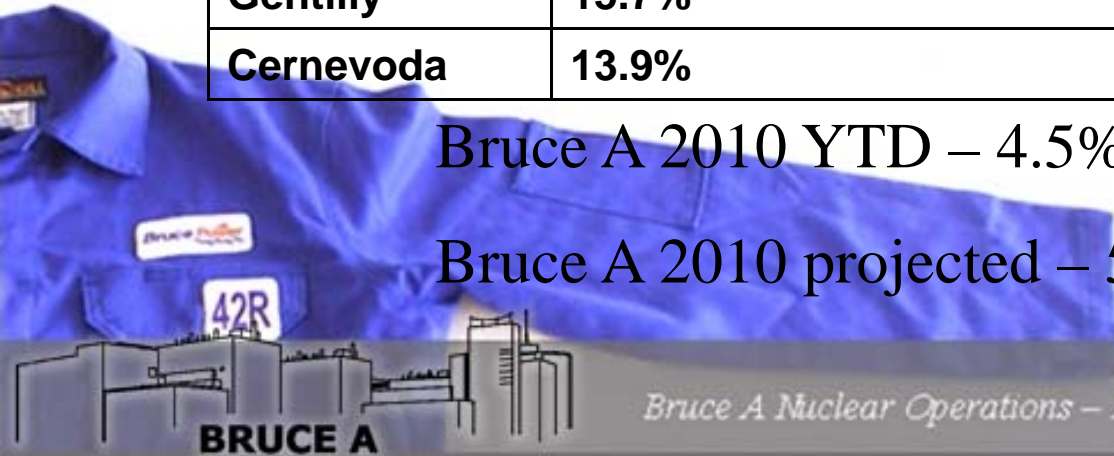
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# CANDU Internal Dose Performance

<b>CANDU 2009 Internal Dose Comparison</b>	
<b>Station</b>	<b>2009 Internal dose as a percentage of whole body dose</b>
<b>Bruce A</b>	<b>2009 - 8.7 %</b>
<b>Bruce B</b>	<b>2009 - 7.6 %</b>
<b>Wolsung</b>	<b>Unit 3 – 47% Unit 4 – 35%</b>
<b>TQNPC</b>	<b>21.8%</b>
<b>Darlington</b>	<b>12.3%</b>
<b>Pt. Lapreau</b>	<b>3.0% (under refurbishment)</b>
<b>Gentilly</b>	<b>15.7%</b>
<b>Cernevoda</b>	<b>13.9%</b>

Bruce A 2010 YTD – 4.5%

Bruce A 2010 projected – 5.4%



# Outage Trends

Outage	Internal Dose [Rem]	% WB dose
A841	29.109	24.1
A831	19.660	8.4
A093	1.613	2.4
A094	9.089	5.2
A1031	6.715	2.4





# How did we do it?

- Culture shift
- Identification and repair of PHT leaks
- Use of Munter units during outages
- Use of Sperien disposable suits
- Reduction in tritium source term
- Unplugged time awareness
- Rigorous investigation of excessive internal dose
- Management focus and oversight

*All internal dose is preventable.*



# Culture Shift in Internal Dose

We went from

It's just tritium dose, there is nothing we can do about it....we are already wearing plastic suits.

To

**All internal dose is preventable**



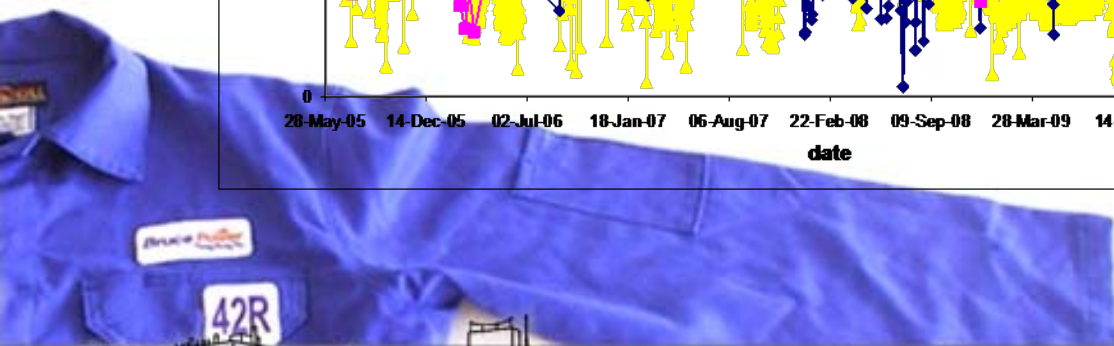
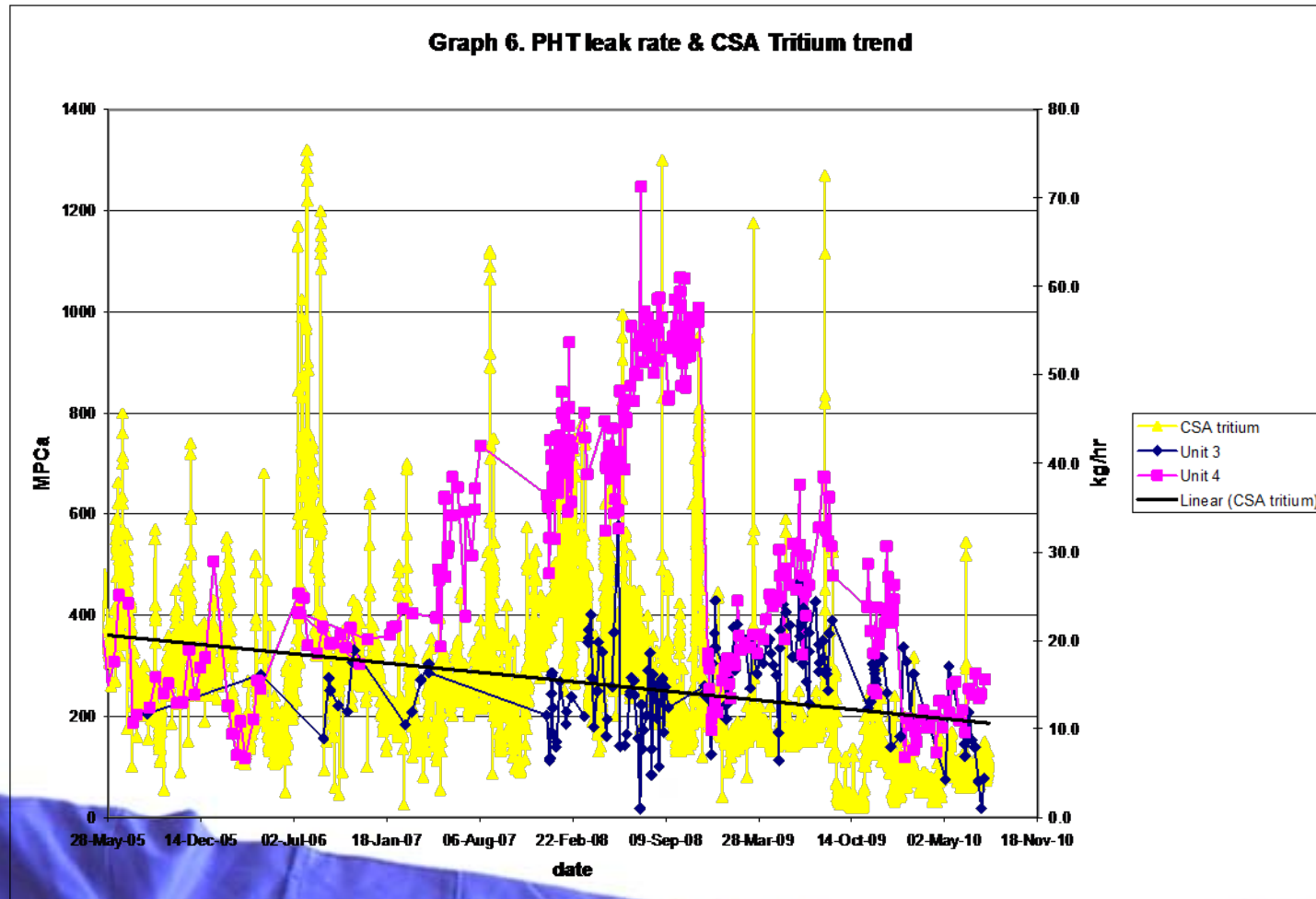
# PHT Leak Rates & Leak Searches

- Numerous PHT leaks
- Leak search techniques improved
  - Use of engineering staff on reactor face
  - Use of mirrors to see behind greylocks
  - Observations at time of insulation removal
- Repair of identified leaks





# CSA Tritium & PHT Leak Rate Trends



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# VVR Corrective and Preventative Maintenance

- Damper actuators were refurbished
- Age-degraded desiccant beds were changed out and depth of bed doubled
- Drier operating parameters, including temperature set-points and cycle time, were optimized.
- Return to service of the ESA Dryer
- Revision of air-purge procedure to allow VVR to remain in service during ice-plugs in vault.
  - Exhaust to CSA stack with air introduced at ESA.



# Use of Munters

- Munter units have been used in vaults since fall 2008
  - Performance has improved since then due to defined ownership and procedures for operation
- 2 units in the same vault used in most recent outages
  - During VBO 2 were placed in Unit 4, none in Unit 3 – however they were effective at tritium mitigation in BOTH units



# Sperien Disposable Plastic Suits

- First used during fall 2008 for west shift campaign only
  - Observed internal dose for west shift workers to be about 2% of WBD
- Continued to increase usage
  - 24% in fall 2009 outages
    - Recommended suit usage in REPs
    - Not all staff qualified
  - 48% in spring 2010 outage
    - Required suit usage for most jobs in REPs
    - Most staff qualified
    - OJE performed for those not qualified
    - Special permission had to be obtained to NOT wear the suit

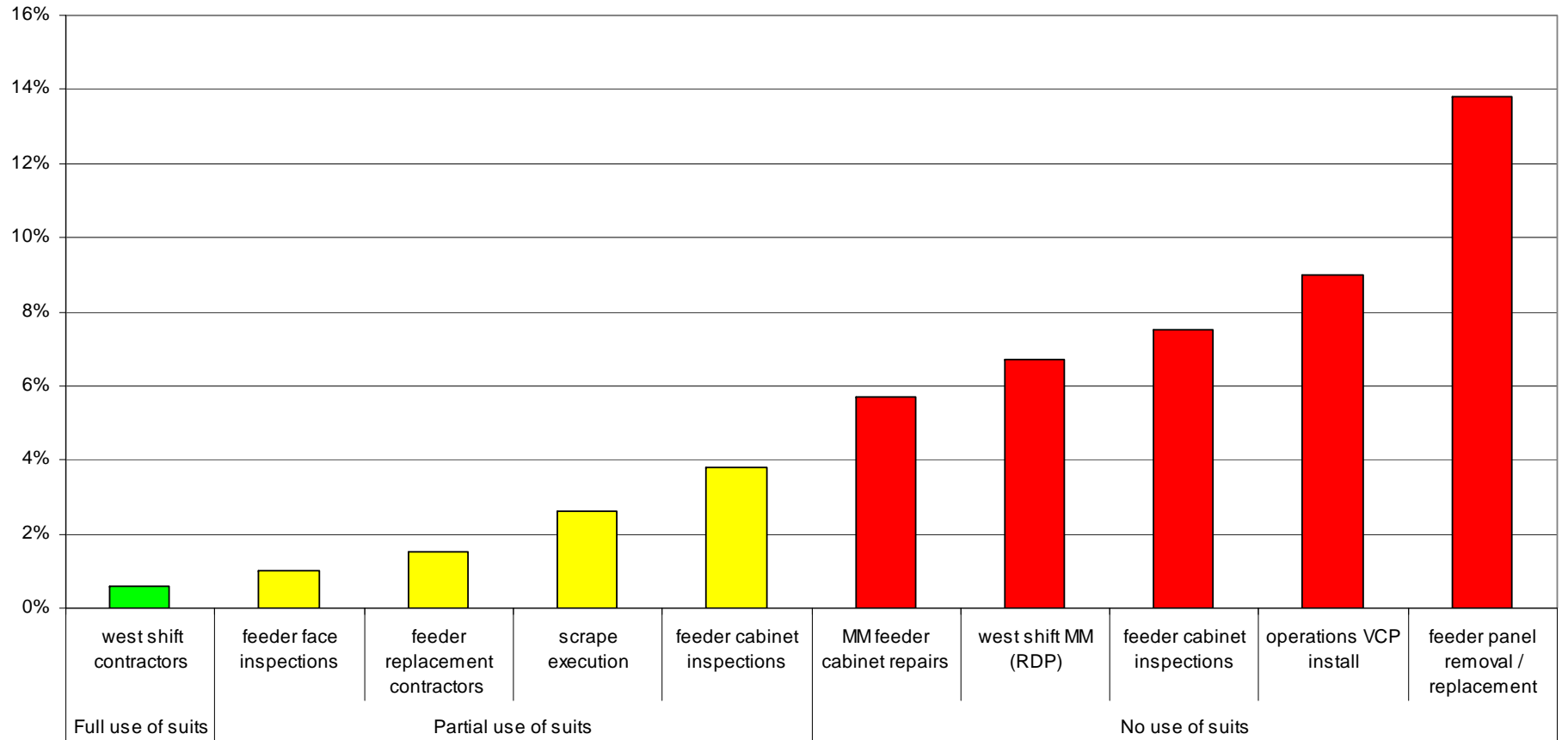


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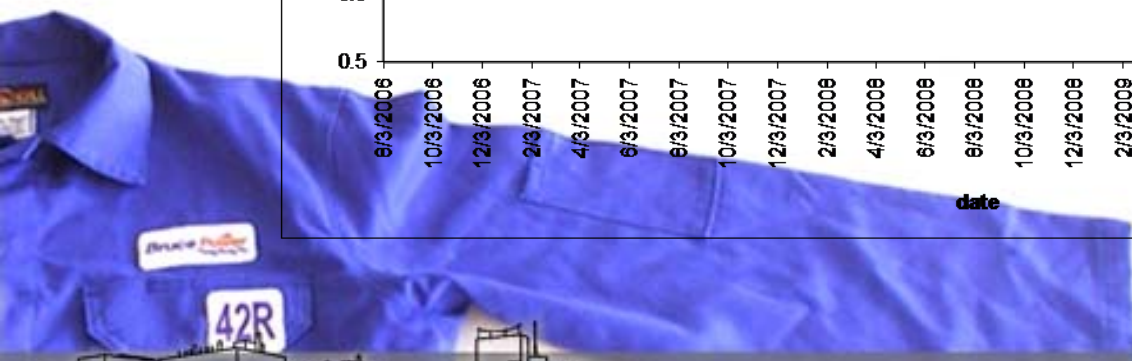
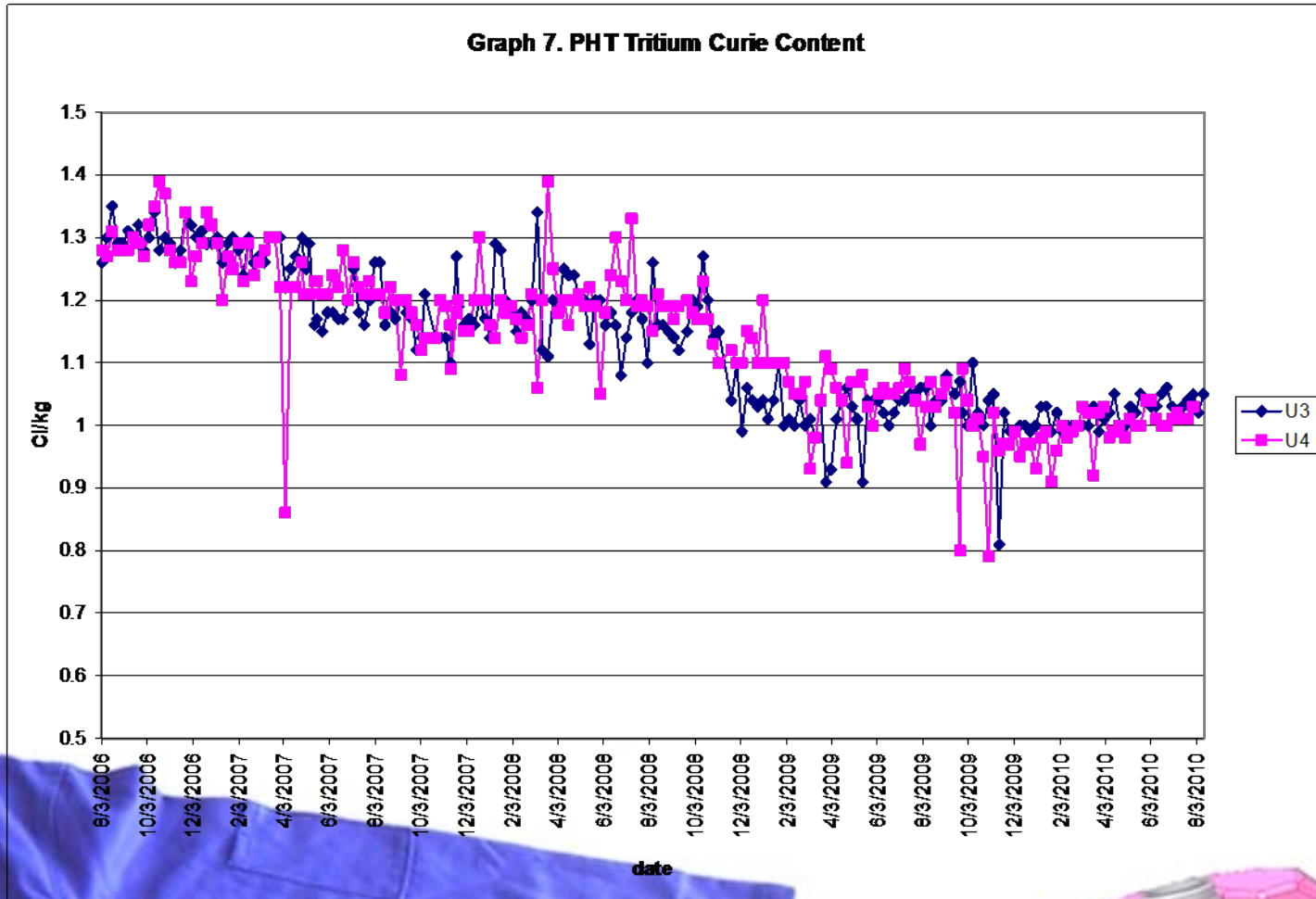
# Sperien Results

Comparison of Percentage Internal Dose by Workgroup Usage of Sperien suits during A1031



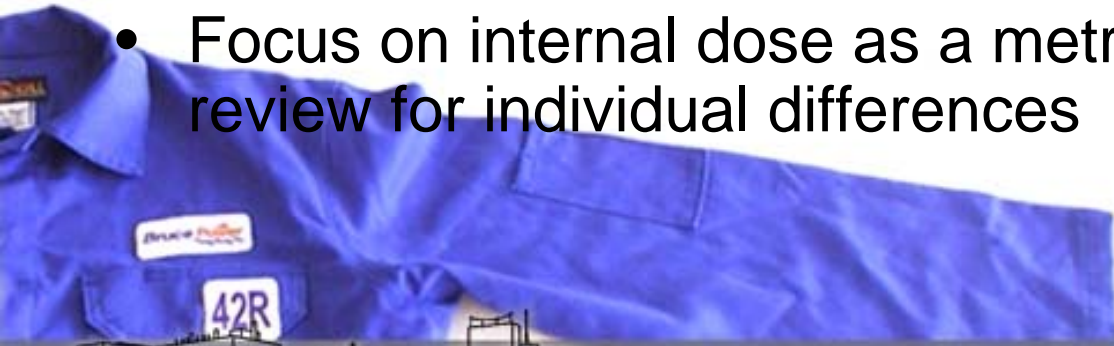


# Reduction in Tritium Source Term



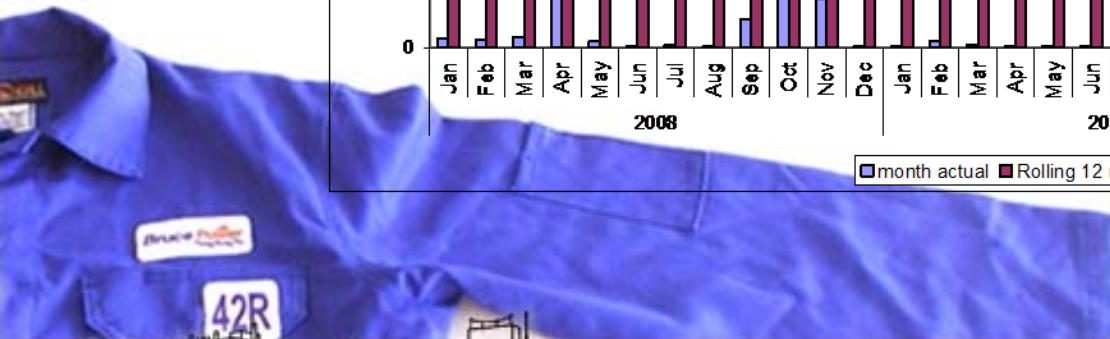
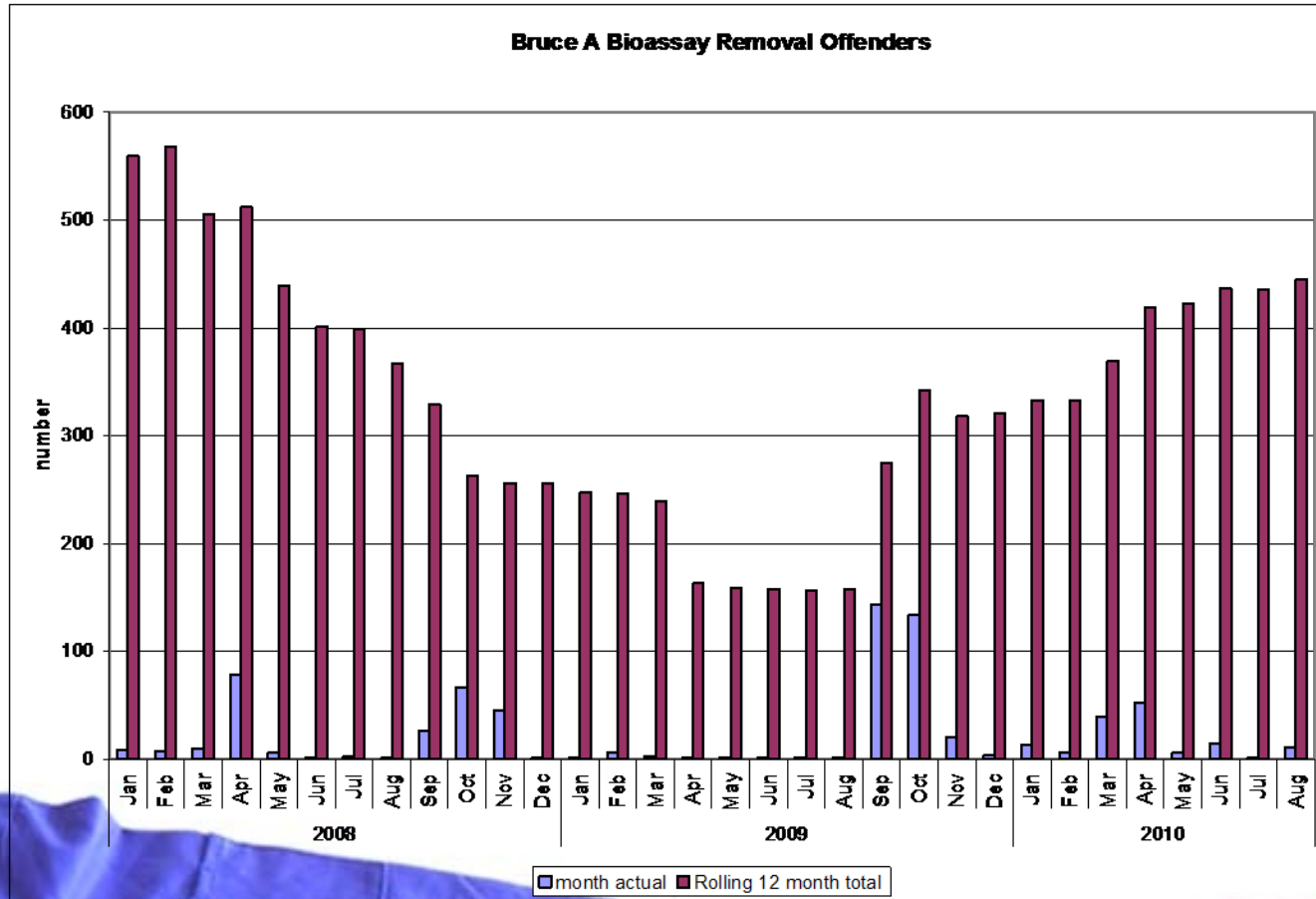
# Worker Practices

- REPs revised to REQUIRE from RECOMMENDED
  - Emphasized unplugged time in REPs and briefings
    - Quantifying an unacceptable unplugged time had a big impact – shock value
    - REQUIRED Sperien suits
- REP quality, more applicable to work
  - Work group ownership of REP
  - Removal of information that does not apply to the work
- Rigorous investigation of excessive dose events ( $> 10 \mu\text{Ci/L}$ )
- Focus on internal dose as a metric on its own, performance review for individual differences



# Worker Practices

- Bioassay compliance removal process



# Management Oversight

- Focus on VVR corrective maintenance prior to outage
- Daily oversight of VVR operation and tritium levels during outage
  - Response to high tritium – taking action instead of increasing REPs
- Munter performance as a daily metric
- Event review boards for excessive dose
- Focus on munter performance
- Weekly ALARA Committee during outages



# Where we are going next....

- Focus on **online** internal dose
  - CSA is similar to the vault – should see same performance
  - Daily review of internal dose implemented
  - Improve worker practices
- Implementation of continuous tritium monitoring in key areas of the station
  - General areas
  - Rooms with chronic tritium or probability of fluctuating results



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# Where we are going next....

- Examination of respiratory protection requirements

<b>Comparison of respiratory protection requirements for tritium</b>			
	<b>Respirator</b>	<b>Air supplied</b>	<b>Plastic suit</b>
<b>Bruce Power</b>	<b>&gt;1 MPCa, &lt; 10 MPCh</b>	<b>&gt;1 MPCa, &lt; 10 MPCh</b>	<b>&gt; 100 MPC, 10 MPCh</b>
<b>Wolsong</b>	<b>&gt; 1 MPCa</b>	<b>10 DACH</b>	<b>50 DACH</b>
<b>Gentilly</b>	<b>2 MPCh</b>	<b>2 MPCh</b>	<b>10 MPCh</b>
<b>TQNPC</b>	<b>1-5 MPC</b>	<b>5 – 10 MPC</b>	<b>10 MPC</b>
<b>Cernevoda</b>			<b>20 DAC 8 DACH</b>

