

Radiation Protection Program Improvements

January, 2011



Bruce Power

- 8 PHW CANDU reactors on a 2,300 acre site
 - 6 operating – Bruce B (4x822 MW units), Bruce A (2x750 MW units)
 - 2 units in refurbishment at BA and planned for other units
- Private company
- 7000 staff and contractors at any time
- Heavily unionized
- Operates like a small village
 - own laundry, fire department, works department, medical clinic



Radiation Protection Issues

- Large loss of experienced Health Physicists in recent years to understand, maintain and improve the program technical basis
- Performance lags industry
 - Collective Radiation Exposure
 - Contamination control performance
- Unusual RP Paradigms unique to CANDU (e.g. internal dose, zoning, self protection) are built into program and used as basis for limited RP staffing model to increase flexibility
- Programs and standards less than industry best
 - RP program document had not been updated since 2001 and based on model from 1970s



Performance - RP Indicators

Performance Area	BA	Proj.	BB
S-99 Reportable Events	5 (7)	2 (3)	6 (7)
All PCEs	322 (149)	74 (83)	615 (147)
All Loose Contamination	50 (30)	5 (9)	69 (30)
Internal Exposure Events	7 (5)	1* (0)	105 (5)
Total External Dose	352 (368)	337 (327)	352 (374)

Actual recorded – target in parenthesis

*144 if include alpha event from 2009



Recent Events

- Two recent, serious events
- Common event factors
 - Radiation risks were not anticipated (cross disciplinary)
 - A large number of personnel who were not doing the work in question were exposed above action levels (indicates loss of control of RP program)
 - When RP instrumentation indicated a hazard was present, the instrument result was not “believed” or “not conservatively responded to”
 - There was a lack of infrastructure (or infrastructure had been dismantled) to mitigate/measure the emergent risks in a timely manner

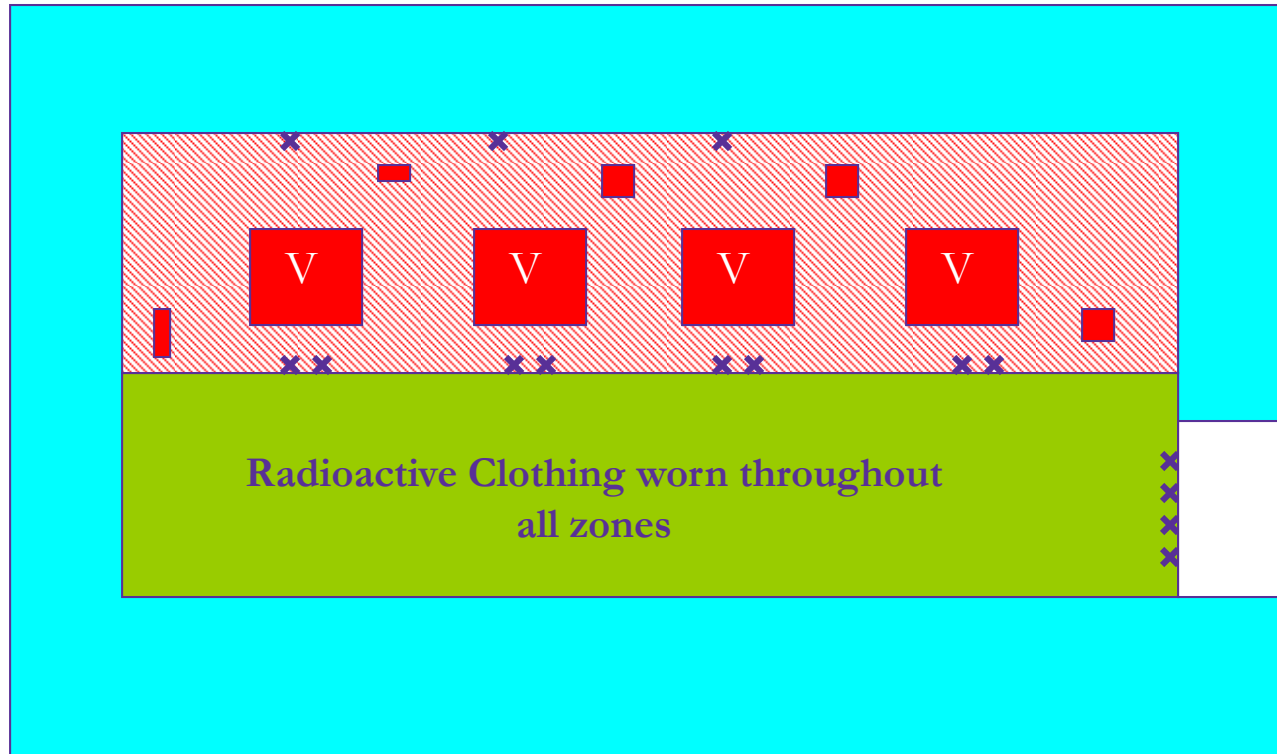


Improvements prior to the events

- Increased sensitivity to tritium hazard and intakes
- Introduced new PPE
- Re-zoning improvements
 - Eliminate browns
 - CeMoSyS
 - Enhanced monitoring capabilities
- Improved dose accountability
- Improved contamination control (restart)
- Increased benchmarking
- Hiring new Health Physicists, enhanced training
- Enhanced RP training



Current Zoning System



 Rubber Areas/Vault (V)

 Zone 3



Existing RPPE

“Browns”
Ensemble

Men’s Radiation
Underwear

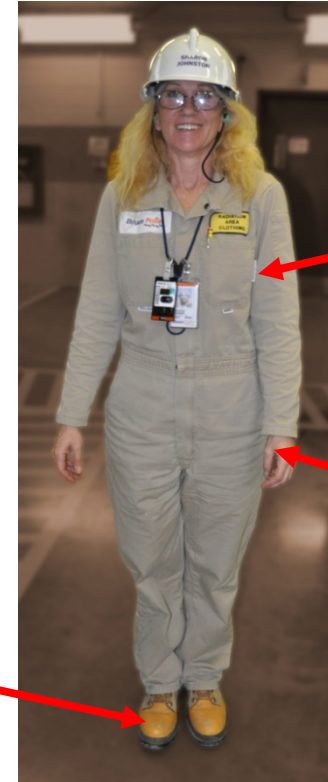
“Rad Greens”
Ensemble

“Khakis”
Ensemble

Women’s
Radiation
Underwear



Rad Boots &
Socks



Improvements made since events

- Use of contract recovery team, hired new RPM, enhanced AHP training and peer to peer challenges
- Implementation of alpha controls across site
- Enhanced H-3 monitoring and response
- Temporary augmentation of RP staff
- Profile of/need for RP raised in organization and accepted as key business objective
 - Management RP summits and senior management presentation re urgency of need for change in RP
 - RP “away” days for staff to focus on RP’s mission and identify RP expectations
 - Teaching how RP impacts overall business to key strategic new “business” managers



Current Focus

- Enforcement of standards and use of stop work authority by RP more rigorously
- Team approach and shared vision
- Development of recovery plan for RP to address:
 - Improved program standards and complexity of change in current system
 - Source term characterization and reduction
 - Organizational structure



Who is accountable for RP ?

- In self protection, the line is responsible for RP task execution
 - A small number of RP staff work on day shift only
 - The use of temporary RP personnel during outages has confused responsibilities further
 - Everyone is an RP “expert” and no respect for or understanding of real RP expertise
- A form of service protection used in restart, but no change in qualifications or expectations
- Accountability for RP needs to be clear with established authorities and focussed staff
- Need well qualified, experienced, trained personnel performing RP for the organisation



RP Recovery Vision

- Have one RP group accountable for the provision of RP services to the site like many other nuclear utilities world wide use
 - “*Service protection*” organisation
- RP would manage all radiological work, movement of radioactive materials, etc, and be accountable for the performance of these activities. Other groups would have defined responsibilities.
- Augmented quality and number of HP resources
- Authorised Health Physicists visible, capable and respected
- Re-zoned plant with zone 3 as an “RCA” with entry controls
- RP fully integrated with radiological work planning and scheduling
- RP using modern technology to identify and control radiological risks
- Major source term reduction plan



Conclusions

- Recovery will be long term operation
- Service protection is a significant change in the organization involving all of the organization
 - Will require significant change management, patience and tenacity to implement
 - Opportunity to create optimal RP support model
- Complexities of change in standards and organization are challenging
- Senior management drive needed for source term reduction
- Urgency to make change was under-estimated and now is being escalated

