Review of Canadian Nuclear Facilities Radioactive Waste Reduction Using Launderable RPPE Programs and the Application of Improved Monitoring

Kent Anderson
Director Canadian Operations
UniTech Services Group, Inc.
kanderson@unitechcdn.com
(800) 344-3824 ext. 166

Presentation Objective

- Monitoring Criteria and Risk
- Change to Launderable Items
  - Considerations and Common Items in Service
  - Cost Evaluation Process
- Materials/Projects – Waste Saved/Avoided
- Ways to Reduce Radioactive Waste Generation

REDUCE • REUSE • RECYCLE

UniTech is Servicing Canadian Markets With:

- Clothing, specialty bags, and respirator decontamination, monitoring and lease
- Clothing, specialty bag, and equipment cover, design and manufacture
- Tool and metal monitoring/decontamination services
- On-site management/shipping- WNSL & ERAP/ export

<u>UniTech Canadian Customers</u>

Ontario Power Generation:
- Pickering Nuclear
- Darlington Nuclear
- Darlington Refurbishment
- Western Waste Management

Bruce Power
NB Power
Canadian Nuclear Laboratories
Candu Energy
ECC Port Hope

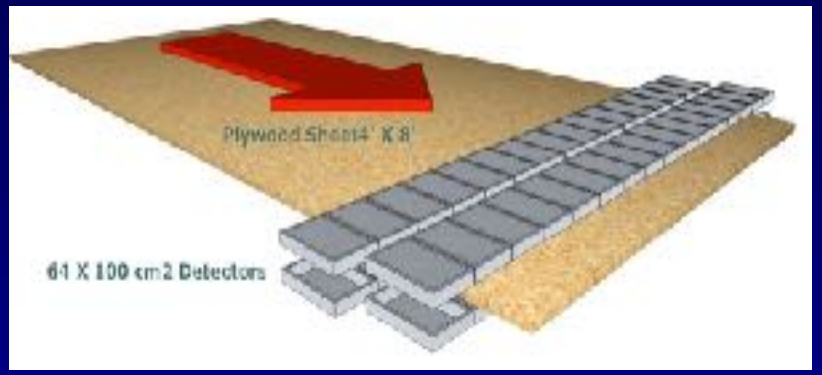
Monitoring Criteria/Risk

The Human Factors associated with Hand Frisking increase risk due to:

- inconsistent detector to item distance
- difficult to obtain 100% item coverage
- difficult to maintain consistent scan speed
- difficult to determine if “clicks” could be at alarm limit
- difficult to determine optimum alarm limit in fluctuating background

Automated monitors significantly reduce risk due to:

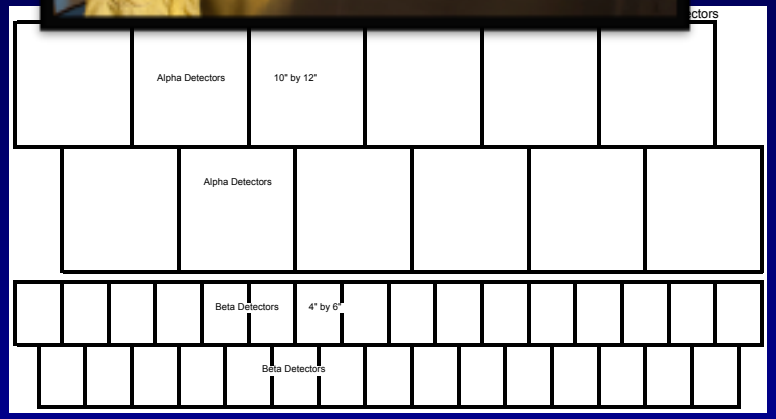
- Fixed detector to item distance
- 100% item coverage w/detector overlap
- Computer controlled belt speed
- Computer controlled/calculated MDA
- User selectable confidence levels and isotopic relative efficiency

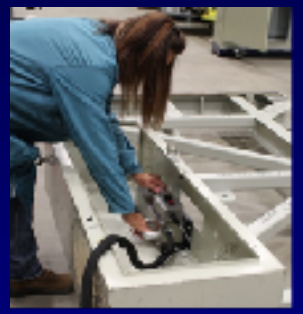


Who cares if you can get it clean. If you can’t properly monitor to verify the absence of radioactivity, then it just doesn’t matter.

Monitoring Criteria/Risk

Using production radiation monitoring equipment to monitor materials for reuse and/or release from controlled areas reduces risk and cost.





UniTech has designed and manufactured many different types of automated monitors to meet customer needs.

Considerations and Common in Service Items

Canada

- Heavy Water reactors
- H-3 is a major hazzard
- No permanent radioactive waste disposal
- Storage is expensive
- Minizing waste is a priority

Considerations and Common in Service Items

Bags/Non-clothing items:

- Improved Features
  - Windows
  - Handles
  - Zippers
- Save Labor Hours
  - Less handling
  - Controlled movement
  - No decon required
- Includes general building cleaning items
- Reduce Waste
- Improve Plant Apperance

Considerations and Common in Service Items

Items have positive impact <u>beyond waste reduction:</u>

Insulation bag - reactor face insulation.

- Was double bagged/removed from vault
- Multiple trips through airlock to remove
- Now, secure insulation within the vault
- Saves man hours/critical path time/significant plastic waste each outage
- Airlock used for more important outage tasks
- Washing between uses not required.

Considerations and Common in Service Items

Items have positive impact <u>beyond waste reduction:</u>

Scaffold bags for vault project work (8’ 10’ and 12’ bags).

- Scaffolding is pre-staged for a specific project.
- Only take in what you need.
- Removed from bag at step off pad and reloaded at step off pad at project completion.
- Don’t have to double bag and clog the airlock making multiple trips.
- Saves significant time and reduces radioactive waste as scaffolding is not cleaned every time.

Cost Evaluation Process

Spreadsheet Can Easily Track All Variables

Allows verification after the fact and adjustment of assumptions

Assumptions:

Single Use Item Information - Actual Costs		
Single Use RPPE Item:	Tyvek Anti-C Coverall	
Item Purchase Price:	$6.59	$/each
Item Weight (KG/each):	0.27	kg/item
RadWaste Disposal Cost:	$26.64	$/kg
Single Use Cost Per Use:		$13.86

Laundry Cost: Projected		
Launderable RPPE Item:	ProTech Anti-C Coverall	
Laundry Cost/item:	$3.15	$/process
First Wash Reject :	3%	rewash
Rewash Cost/Item:	$3.15	$/process
Item Replacement Rate:	2%	replace
Item Replacement Cost:	$58.06	$/item
Lease turns/month:	1.5	worn/month
Lease cost/month:	$2.59	$/item/mo.
Launderable Cost Per Use (projected):		$6.13

Actual Savings:

Single Use to Launderable Coverall Comparison	6-year	Annual
Total use:	489,415	81,569
Total Launderable Costs:	$2,922,106	$487,018
Launderable Cost Per Use	$5.97	$5.97
Single Use Coverall Costs:	$6,781,067	$1,130,178
Total $ saved	$3,858,962	$643,160
% saved	57%	57%
KG of Waste Avoided	133,477	22,246

Actual versus projected costs should be measured.

Keeping score allows continued investment in reduction activities.

Cost Evaluation Process

For non-clothing items additional variables are considered:

- Labor Saved
- Frequency of Evolution
- Waste Avoidance Per Evolution
- Safety
- Storage Considerations

Consider “Safety”, “Green”, “Labor Savings”, “Dose” and other options when financials are not overwhelming. It’s not always about the money.

Tents with windows

- Cooling = blue
- Rad Work = yellow
  - Better view for inspectors
  - Reduces number of people who have to dress out.
  - Reduces the “hide and seek factor” no place to hide!
- FR options for both fabric and window material available

Cost Evaluation Process

Innovation and the future: Product development is a continous improvement process.

- Cut Resistant (4) Glove Liners
- Booties to Climb Ladders/Scaffolding
- Launderable H-3 Hood
- Air distribution within Plastic Suit
- Zip Off double plastics

Materials/Projects: Waste Saved/Avoided

5 year refurbishment project - Avoided 3,581M3 of radioactive waste. Saved $3M over just purchasing single use clothing.

Launderable Item	Project Qty Processed
Yellow ProTech Anti-C's	688,474
Rubber Glove	3,072,016
Cotton Liners	1,845,250
Black Booties	1,512,387
Blue ProTech Booties	1,962,067
Laundry Bags	217,129
Light Grey F/R Booties	129,086
Black Rubber Overshoes	119,595
Blue ProTech Oversuit	88,417
Micro Fiber towel	83,593
Light Grey F/R Oversuit	30,549
Micro Fiber Mitt	30,324
Mop, Blue Polyester	16,951
PAPR Cover	8,500
Light Grey F/R Anti-C's	7,353
Tarps	1,045
Elephant Trunk	127
HEPA Filter Change/Maintenance	60
Total Items Processed	**9,812,923**

Item	Total Process Quantity	Launderable Actual Cost/Use	Total Launderable Cost All In	Single Use w/Radwaste Costs Purchase Cost Total	Radwaste Cost Total
1 ProTech Anti-C	688,474	$5.21	$3,589,091	$3,690,221	$6,691,967
2 Rubber Glove	3,072,016	$0.47	$1,439,340	$1,244,166	$5,598,749
3 Cotton liners	1,845,250	$0.50	$919,051	$215,894	$1,120,989
4 Black Booties	1,512,387	$0.35	$534,449	$272,230	$1,073,129
5 ProTech Bootie	1,962,067	$0.78	$1,539,136	$7,024,200	$3,559,974
			$8,021,067	**$12,446,711**	**$18,044,809**
				Total Savings on top 5 items @ $16/lb	**$22,470,453**
				Total Savings on top 5 items @ $8/lb	**$13,448,049**

Materials/Projects: Waste Saved/Avoided

6 year summary – 6 unit station, 4 unit station, and 2 years of their first mid-cycle refurbishment. Avoided 9,886M3 of radioactive waste.

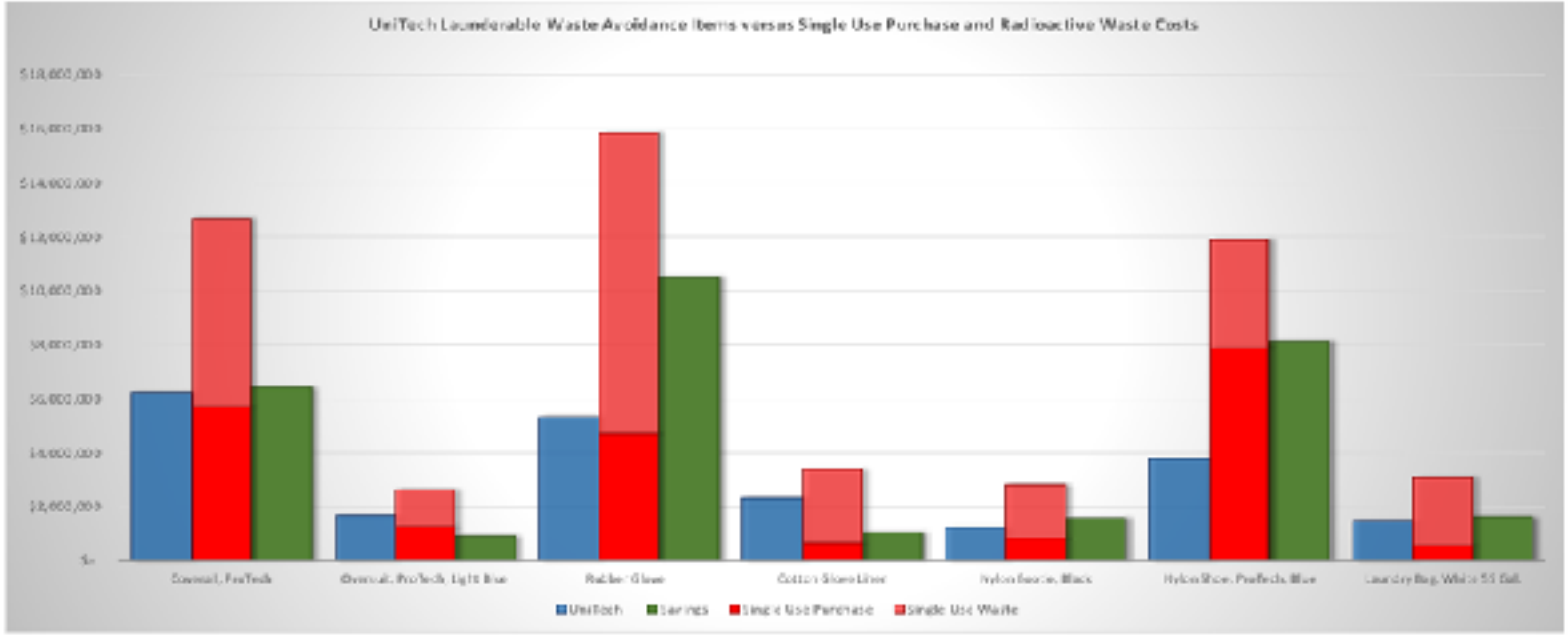
Station Data

Stations 1, 2 & 3

TOTAL $ and m3 Savings per ITEM

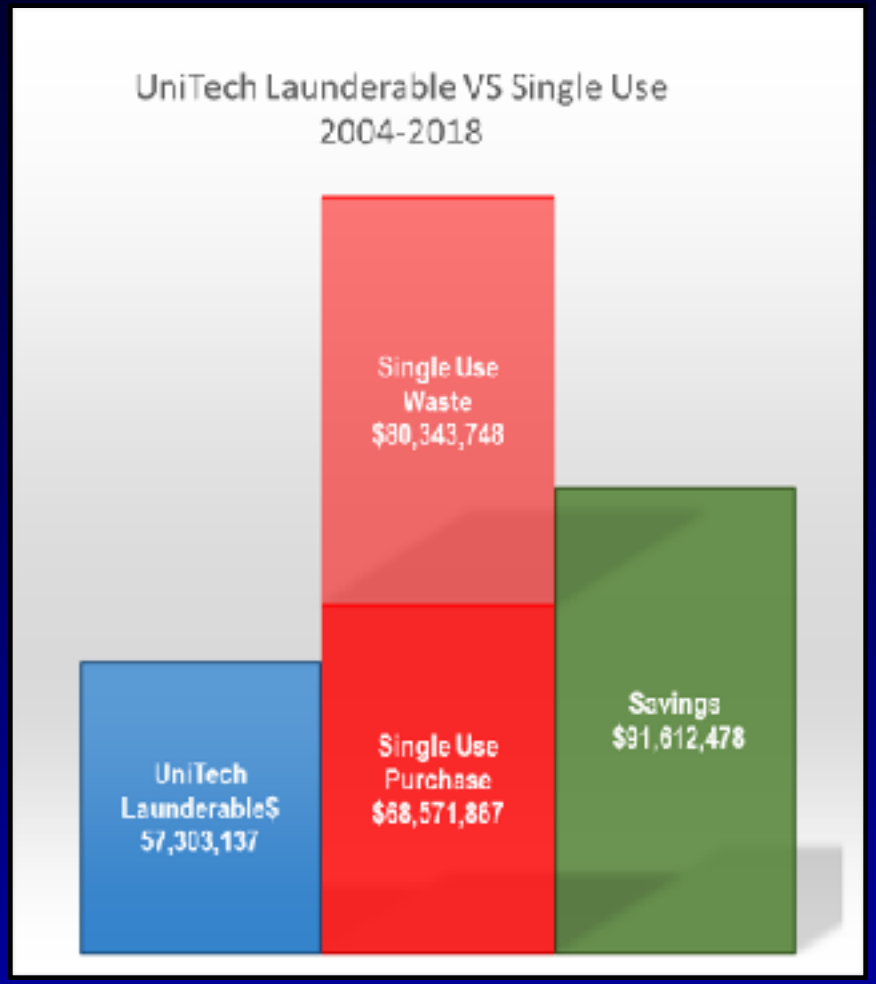
LEASED **PPE** ITEMS

	UniTech Launderable	Single Use Purchase	Single Use Waste	SAVINGS	Single Use TtI	m3 saved
1 Coverall, ProTech	$ 6,249,068	$ 5,879,622	$ 6,987,688	$ 6,418,222	$ 12,867,290	2254
2 Coverall, ProTech, Light Blue	$ 1,880,648	$ 1,286,631	$ 1,348,435	$ 924,316	$ 2,614,965	435
3 Rubber Glove	$ 5,343,820	$ 4,715,907	$ 11,122,862	$ 10,494,949	$ 10,836,769	3588
4 Cotton Glove Liner	$ 2,327,857	$ 686,977	$ 2,714,135	$ 1,056,556	$ 3,384,113	876
5 Nylon Bootie, Black	$ 1,214,556	$ 652,142	$ 1,874,523	$ 1,612,119	$ 2,826,666	637
6 Nylon Shoe, ProTech, Blue	$ 3,753,829	$ 7,888,901	$ 3,994,521	$ 8,129,620	$ 11,883,823	1289
7 Laundry Bag, White 55 Gal	$ 1,484,082	$ 584,312.89	$ 2,504,124	$ 1,624,434	$ 3,088,497	808
TOTALS	$ 22,043,516	$ 21,856,854	$ 30,646,288	$ 30,259,606	$ 53,303,122	9886



Materials/Projects: Waste Saved/Avoided

Significant savings have been acheived. Working with station staff to format/distribute data to station and public. They need to know everything possible is being done to minimize future liability/waste.



- UniTech has decontaminated over 49M waste avoidance - RPPE items for Canada.
  - Over 3.5M anti-C dress outs
  - Over 35 custom bags and cleaning products

Materials/Projects: Waste Saved/Avoided

Mid-Cycle Tool Set Demobilization Project. 1,136 metric tons. 744 packages – 100 of wich were Type A or IP2. Materials decontaminated and released for unrestricted use (scrap metal).

Materials/Projects: Waste Saved/Avoided

Decontaminated, surveyed and released 3M pounds of materials for unrestricted use/reuse

Ladders
Hand Tools
Electric tools
Extension cords
Welders
Drill Presses
Fork lifts
PHT Motor

Scissor lifts
Scaffolding
Chain Falls
Computers
HX Plates
Machine tools
Transformers
Air Hoses

Pipe hangers
Electrical Cables
Structural Steel
Refuel drive motors
Instrument Cable
Vent Fans
Power Panels









Ways to Reduce Radioactive Waste Generation

- Waste Avoidance through Launderable/reusable RPPE: A Continuous Improvement Process
- Tool/Scaffold/Equipment Decon/Verify Absence of Activity: clean and return tools and equipment to contractors to eliminate or reduce back end project liability using state of the art monitoring equipment.
- Ongoing demobilization of construction debris (structural steel, cabling, motors, etc.) using off-site decontamination/monitoring services
- Off-site Waste Sorting, looking for opportunities to:
    - Expand the use of reusable items
    - Recover recyclable materials
    - Incinerate materials, reducing the long-term footprint
    - Volume reduce solid materials
- Recover and store contaminated materials/tools until reuse is needed and finally,
- Refurbishment of contaminated tooling/equipment for continued reuse.

Ways to Reduce Radioactive Waste Generation

Budgets:

1)Typically, the savings (labor, waste, purchase cost) may not be in the budget of the group who saves the money (typically laundry)
2)Budgets should be aligned so the waste minimization program can fund future savings
3)If an organization saved cost (waste group) by another group (say laundry) money should be transferred or credit scored
4)Aligning all the buckets of money so savings can be scored will keep minimization efforts moving forward for maximum savings
5)Keeping score is critical to keeping senior management support, ensuring budgets are available, and interest is maintained.
6)It takes senior management to cross organizational budgets.
7)This is more important with the aging workforce, and the need to drive efficiency in all areas.

8)Station staff and the public should be included with waste avoidance activities. They need to know everything possible is being done to minimize future liability/ waste. The savings should be celebrated.

Summary

- Major, opportunities exist to significantly improve the reduction of radioactive waste volumes and the associated long-term liability and costs via reuse, recycling and waste prevention strategies
- Typically, during refurbishment/decommissioning projects (and even routine maintenance), the resources, capacity and expertise required to create and reliably deliver an effective tool & metal radiation survey and decontamination program are not readily available onsite
- The increased volume of reusable/recyclable materials can be achieved by employing a proven combination of:
    1. Advanced, cost effective, accurate, reliable and precise monitoring techniques/ technologies which reduce/eliminate risks associated with inefficient, sub-optimal, manual techniques
    2. New, improved decontamination processes which are applicable to an extremely wide range of items
    3. Prevention of item/tool contamination at source via the use of launderable, multi-use protective strategies
    4. A comprehensive QA/QC methodology that captures the necessary information and process data in a full documentation package for Regulatory Compliance