

Greening Medical Imaging in BC's Lower Mainland Health Authorities

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Executive Summary

Greening Medical Imaging operations in the Lower Mainland Health Organizations equips practitioners with a course of action to demonstrate their responsibility towards the environment by ensuring that their operational procedures do not hamper the sustainability of the larger ecosystem while promoting the wellbeing of their patients.

Drawing on increasing opportunities identified by Green+Leaders in the Lower Mainland to improve the environmental performance of medical imaging operations, the Energy and Environmental Sustainability team at the Lower Mainland Health Organizations, through the Greening Medical Imaging project, researches environmental opportunities in medical imaging departments across five (5) health facilities in BC Lower Mainland with respect to helping them lower their environmental footprint and improving resource efficiencies in energy savings, waste and toxicity reduction, waste diversion including recycling, product re-use and diversion from landfills.

With the use of interviews, site visits, observations and high-level waste bin audits, the research contributes to understanding the contexts of operations in medical imaging departments so as to meet the needs of staff and ultimately improve environmental performance in a way and such that can be replicated in and scaled across other healthcare departments. The project identifies a greater need around conserving energy resources, greening procurement and general operations

by identifying upstream and downstream opportunities to reduce packaging and unnecessary production of material waste as well as improve energy savings.

Table 1.1.

Overview of Greening Opportunities Identified by Interviewed Staff:

1. Patients' prescription and clinical profiles can be kept electronically and made accessible to all users rather than being printed and faxed or filed. A need for system changes to effect digitized communication of patients' reports and profiles.
2. Put blanket warmers, gel warmers and contrast warming cabinets on timers. Switch off equipment when not in use.
3. Use plastic bins or re-usable holds for patient garments, instead of disposable bags. Wash bins or holds at end of each day.
4. Absorbent tri-pads can come in larger packages and reduce soft plastics waste.
5. Supplies do not have to come in plastic bags inside a bin; they could just arrive in the bin itself.
6. Look into using re-usable cups and trays for patients' personal effects, (Replace 'save a day' trays).
7. In interventional radiology, other than using disposable flannel linens, a wipeable positioning sponge could be used to position patients for tests.

Introduction

Investigating opportunities to greening medical imaging operations is not only a climate-smart initiative that minimizes environmental impact, but also one that has the potential to promote health, resource and economic efficiencies.

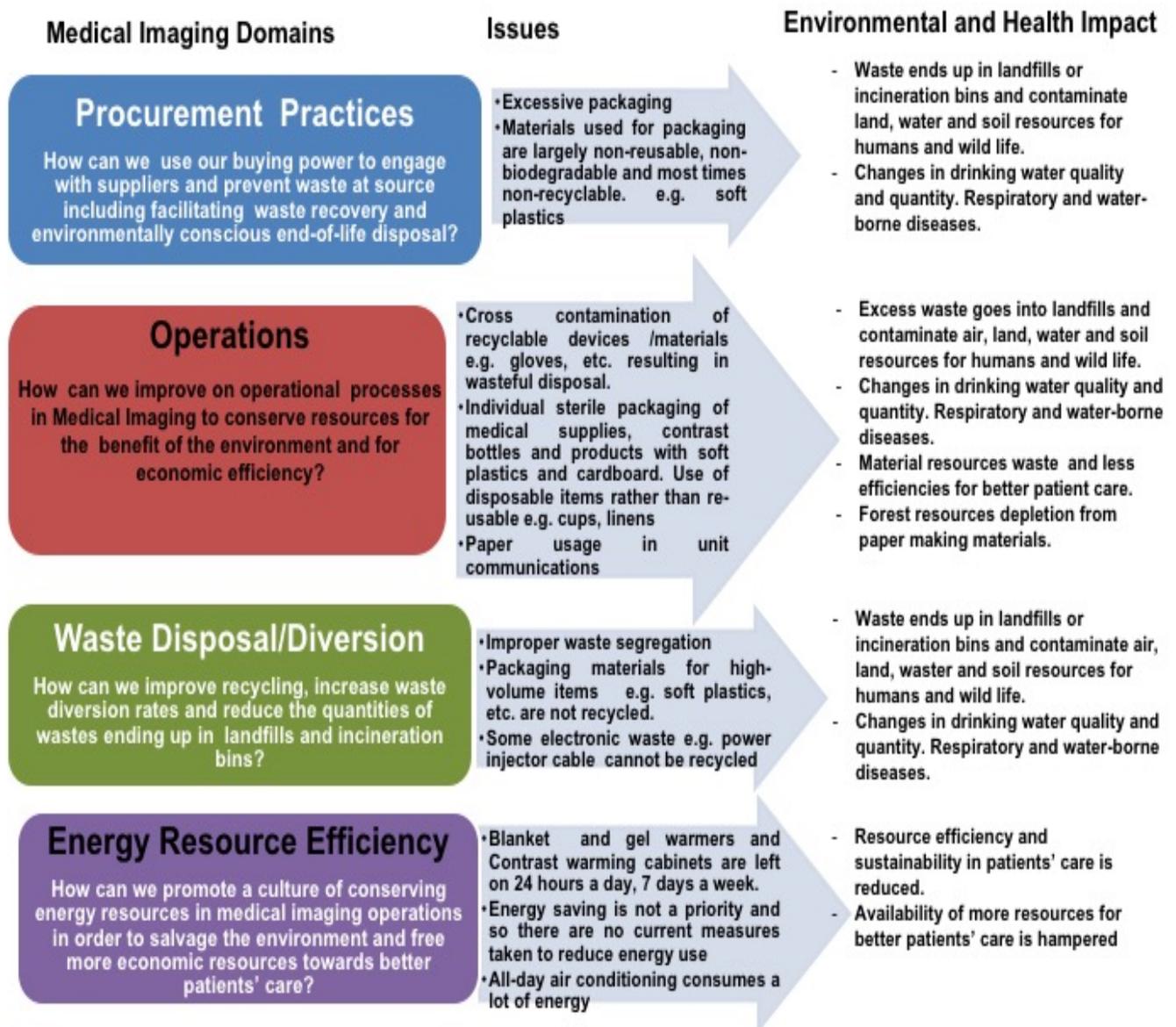
Motivation for the Project

The work is motivated by three primary drivers:

- i. Recommendations from a human factors study on the LMHOs standardized recycling program that identified the need for department-specific resources and education.

Figure 1.1.

Environmental and Health Impacts of Operations in Medical Imaging



- ii. Opportunities identified by existing green champions in medical imaging and other departments in specific sites that could be leveraged and scaled out to benefit units at other sites.
- iii. A growing recognition from experience within the energy and environmental sustainability team that there are opportunities to create benefits and efficiencies at a greater scale when working on department-wide initiatives that address systems-level changes.

Objectives of the Project

- i. Identify environmental impacts of operational processes and procedures in Medical Imaging in terms of the waste generated.
- ii. Engage with front-line employees and management to identify existing knowledge and awareness of environmental impacts of their operations as well as attitudes towards greening the department.
- iii. Identify current activities at specific sites that reduce environmental impacts and that could be shared department-wide.
- iv. Identify research lessons and best practices in other hospitals and health organizations for greening medical imaging departments.
- v. Develop short, medium and long-term strategies to greening medical imaging, including stakeholders, partnership involvement, and potential pathways to implementation.

Method

Of the 25 acute sites in the Lower Mainland Health Organizations, the project adopted 5 pharmacy departments across five (5) selected health facilities. The criteria for selecting

recruited medical imaging departments and respondents were based on existing contacts through the Green+Leaders programs and sites that have significant operations such as Vancouver General Hospital and BC Cancer Agency. Availability of staff with demonstrated keen interests in lessening the environmental impact of their unit operations was also a considered factor.

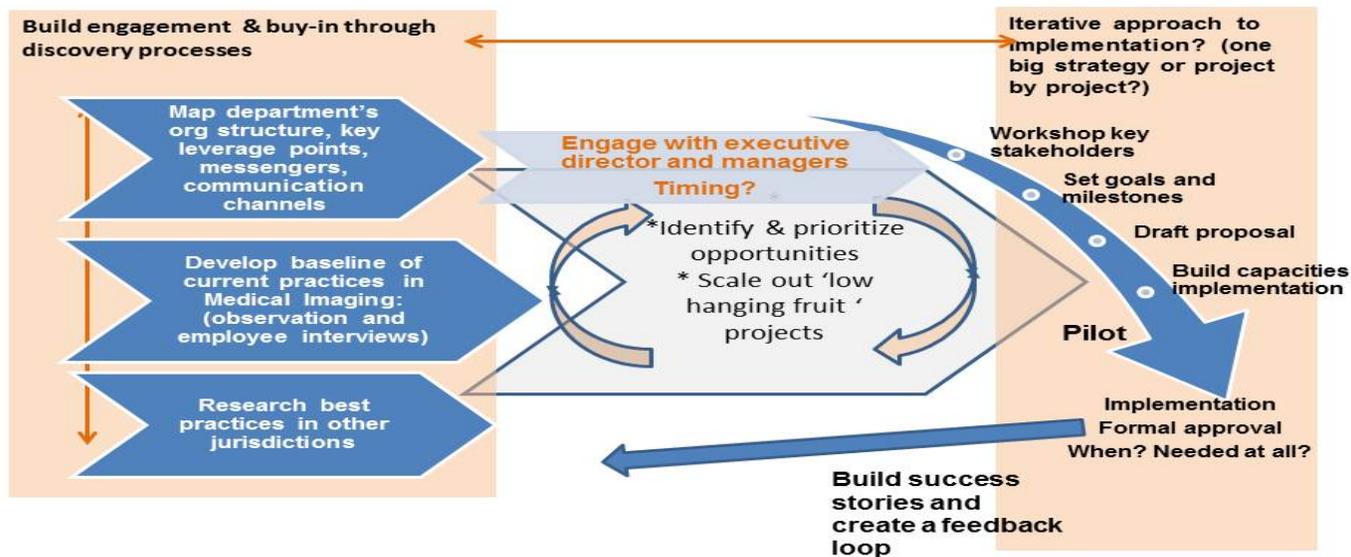
An initial information gathering consisted of site visits, high-level visual audits of recycling and garbage bins in the departments, observations of how waste is generated and disposed of, and interviews of frontline and interested staff to identify the following key indices of focus.

- High volume clinical garbage and recycling items.
- Packaging materials and operations that generate the most waste and their corresponding sources.
- Existing good practice(s) that can be shared to other sites.
- Opportunities for energy savings, improved waste reduction and waste disposal (resulting in increased waste diversion or a reduction in total waste).

Aside from researching waste reduction opportunities, interviews also uncovered waste diversion challenges as well as opportunities around energy savings, improved culture of re-use and recycling practices as well as waste disposal practices. Through these processes, interview respondents identified opportunities that could be 'low-hanging-fruit' pilot projects to be tested for their replicability and scalability across facilities. Upstream considerations, which entail working with manufacturers, purchasing groups, distribution centers and others involved in procurement processes, were also identified. These are noted in the recommendations listed below in table 1.4.

Figure 1.2.

Strategy Process



Site Visits and Interviews

Table 1.2. Facilities Visited and Interview Respondents in Medical Imaging

Health Authority	Facility Site	Name of Respondent	Job Title	Sub unit	Nature of Contact
VCH	Sechelt Hospital	Lauri Dunk	Medical Technologist	Radiology	T-con
PHSA	BC Children Hospital	Pauline Dionne	Medical Technologist	Interventional Radiology, Cardiac Imaging, Angiography Suite	T-con
VCH	Vancouver General Hospital	Mindy Dobbs and Indra Zeidaks	MRI Technologists	MRI	Site visit
FH	Abbotsford Regional Hospital and Cancer Centre- (ARHCC)	Joanne Andersone	Procurement Support Aide	Medical Imaging Procurement	Email Interview
FH	Abbotsford Regional Hospital and Cancer Centre - (ARHCC)	Lorie Marchinkow	Supervisor, X-Ray/Interventional Radiology	X-Ray/Interventional Radiology	Site visit
PHSA	BC Cancer Agency	Christine Kamrudin	Medical Technologist (PET Technologist)	PET- Positron Emission Tomography	Site visit
VCH	VGH	Tim Friesen	Supervisor, General Radiology	General radiology	Site visit

Findings and Discussions

Site-Specific Biggest Sources of Waste and Recommendations by Respondents

Each of the respondents interviewed identified top waste items (See figures 1.3. and 1.4. below) in their units and the biggest source of waste either from high-volume items used on a daily basis or packaging materials that generate the most waste and their corresponding sources.

Opportunities for Efficiencies Identified By Staff (Respondents)

Recommendations, which are based on identified opportunities for initiatives around waste reduction, improved waste diversion and recycling, were also made by the respondents. Table 1.3. below itemizes site-specific sources of waste in medical imaging departments along with recommendations collated from interview respondents.

Figure 1.3.

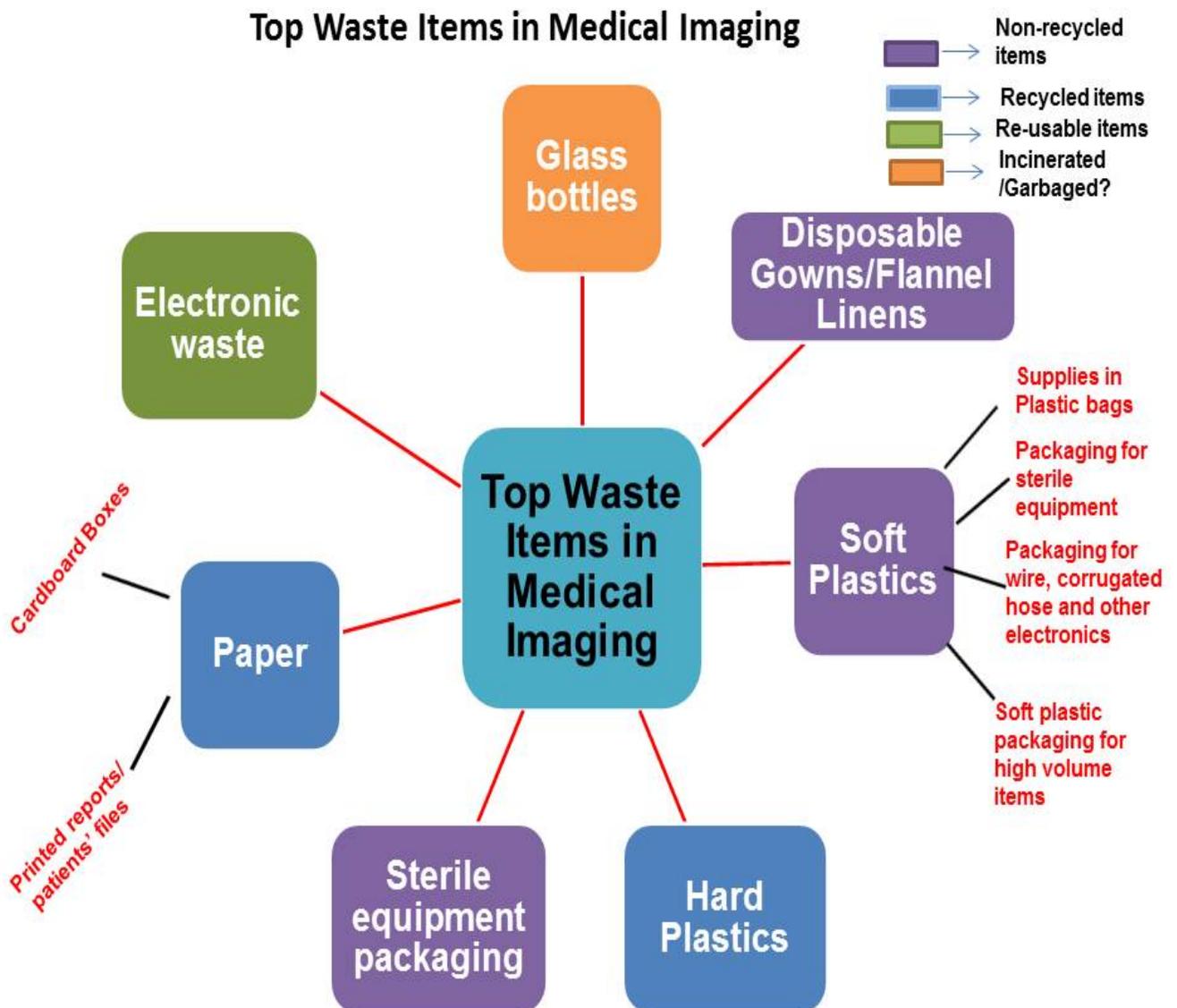


Figure 1.4. A Word Cloud Representation of High-Volume Waste Items in Medical Imaging



Table 1.3. Greening Opportunities Identified in Medical Imaging Department

Waste Items	Sites Implicated	Opportunities Identified by Medical Imaging Staff on Initiatives for waste reduction and improved recycling
<p>Soft plastics packaging: - 1. Supplies come from stores in plastic bags within a bin.</p> <p>2. High-volume items most of which are packaged or made using syringe, gloves, sterile gels, absorbent tri-pads, pre-loaded syringes, plastic cups for drinking water by patients, 'save-a-day' trays, and plastic urinals.</p>	All sites	<p>1. Supplies do not have to come in plastic bags inside a bin; they could just arrive in the bin itself.</p> <p>2a. Absorbent tri-pads can come in larger packages and reduce soft plastics packaging.</p> <p>2b. Look into using re-usable cups and trays for patients' personal effects, (Replace 'save a day' trays).</p> <p>2c. Investigate changing from plastic to paper urinal bed pans</p>
<p>1. Paper from printed reports of patients' profiles, batch reports, duplication of reports.</p> <p>2. Paper printed for patients' charts and as part of PACS system issues in which digital images cannot be transferred to PACS and so are printed and scanned; (75-80 pages/day) are printed.</p>	ARHCC, VGH, BCCH, Sechelt Hospital	<p>1. Patients' prescription and clinical profiles can be kept electronically and made accessible to all users rather than printed and faxed or filed.</p> <p>2. System changes to effect digitized communication of patients' reports and profiles</p>
Cardboard boxes from contrast bottle packaging	VGH	Contrast bottles could be larger and sent in a flat box instead of being individually boxed.
Sterile equipment for lumbar puncture has surplus of hard and soft plastic packaging. Often, the packaging is plasticized paper, plus a wrapped plastic tray. The soft plastic end in the garbage	BCCH	Opportunities should be investigated as to whether the plastic tray that holds lumbar puncture procedure tools could be recycled?
<p>1. Flannel linens are used to position patients for tests (8 per patient = 18-24 per day).</p> <p>2. Disposable plastic bags for keeping patients' garments</p>	BCCH	<p>1. In interventional radiology, other than using disposable flannel linens, a wipe-able positioning sponge could be used to position patients for tests.</p> <p>2. Use plastic bins for patient garments, instead of disposable bags. Wash bins at end of each day.</p>
<p>1. Energy waste: Blanket and gel warmers are left on 24 hours a day, 7 days a week</p> <p>2. Contrast warming cabinet is left on, though used for procedures only on Wed and Fri.</p>	BCCH, Sechelt Hospital, VGH, ARHCC, BC Cancer Agency	<p>1. Put blanket warmers and gel warmers on timers. Switch off equipment when not in use.</p> <p>2. Put contrast warming cabinet on a timer or turn on/off manually.</p>

Good Practices Snapshots

In the course of the interviews, some of the respondents shared good practices in their units and these are collated as stories to be shared

on the GreenCare website. See figures 1.5. and 1.6. below.

Figure 1.5.

Good Practice Story

Demand for low-waste and lightweight packaging materials from product manufacturers/suppliers

By Lorie M., Abbotsford Regional Hospital and Cancer Centre

“When I was at VGH, we asked a supplier to change an adaptor valve that came in unnecessarily oversized packaging. Reducing the size of the packaging was important not only for the environment but because the valves couldn’t be stored properly. It didn’t take them very long and they made the change.”

Figure 1.6.

Good Practice Story

Paper-lite Operations

By Tim Friesen, VGH

“Here, in the Nuclear Medicine unit in VGH, patient information sheets are printed as 4 per sheet instead of using one per patient. We see 30-50 patients per day. This reduces excessive waste generated from printed patients’ information. We also have stopped using paper questionnaires for patients as info is available electronically.”

Recommendations from Literature Research for Greening Hospital Pharmacy and Medical Imaging

Table 1.4.

	Generate Less Waste	Utilize Less Energy and Water	Deploy a Consolidated Use of Assets	Set Green Goals and Measure them
Green Operations	<p>Make entire medical imaging operations paper-lite or thoroughly paper-less. <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012.]</i></p>	<p>Reinforce a digital system of communications between units and with other departments <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012].</i></p>	<p>Asset-sharing across units in a Medical Imaging department. <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012].</i></p>	<p>Inculcate green and environmentally-responsible goals into procurement and operational policies e.g. emission- <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012].</i></p>
	<p>Patient information should be digitally accessed by physicians, pharmacist and other healthcare professionals without printing on paper and faxing <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012.]</i></p>	<p>Use eco-friendly cleaning supplies/products <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012].</i></p>		<p>Establish, monitor and measure and green goals in operations e.g. waste reduction goals, energy-saving goals, equipment 're-purpose' goals <i>[Environmental Advisory Group ("Greening your Pharmacy"), 2012].</i></p>
	<p>Use of biodegradable plates and cups (<i>Chawla, 2017</i>)</p>	<p>Utilize modern technologies in the pantry and toilets, such as installing an automatic faucet that reduces water consumption (<i>Chawla et al; 2017</i>).</p>		

Environmental Advisory Group (EAG).Your Pharmacy. J Pharmacy Practice. [Cited 2012 June 22] CanadianHealthcareNetwork.ca. Available from: https://www.ecolpharm.com/medias/iw/PPR_JulyAug_Green_openers.pdf

Chawla A, Chinchure D, Marchinkow LO, Munk PL, Peh WC. Greening the Radiology Department: Not a Big Mountain to Climb. Can Assoc Radiol J 68 (3), 234-236. 2017 May 11. Available from [http://www.carjonline.org/article/S0846-5371\(16\)30155-3/fulltext](http://www.carjonline.org/article/S0846-5371(16)30155-3/fulltext)

Green Procurement	Explore opportunities for waste reduction and product re-use with Suppliers	Adopt Green Purchasing Policies and Groups	Demand for Reusable and Recyclable Products and Packaging
	<p>a. Engage suppliers to explore opportunities for waste reduction and re-use around sustainable packaging of products made from biodegradable and reusable materials (Reed and Bahr, 2015)</p> <p>b. Instead of soft plastics, packaging materials can be made from biodegradable materials (Cowbell, 2008; Environmental Advisory Group ("Greening your Pharmacy"), 2012.)</p>	<p>a. Have an environmental purchasing guide/policy (Campbell, 2008).</p> <p>b. Check with your manufacturer/suppliers to ensure they have environmental policies (Campbell, 2008)</p> <p>c. Bring together purchasing groups and distribution vendors in green purchasing workshops to deliberate on green purchasing initiatives for medications, packaging materials, transportation and storage processes and unit operational equipment (Campbell, 2008).</p>	<p>a. Purchase biodegradable materials for use in the department in order to reduce prevent or minimize waste generated (Environmental Advisory Group ("Greening your Pharmacy"), 2012).</p> <p>b. Demand from product manufacturers/suppliers for low-waste and lightweight packaging materials that use less volume and use renewable, recyclable and compostable materials. E.g. rolls of paper used for procedures can also be made from biodegradable materials. (Campbell, 2008).</p>

Waste Diversion and Disposal	Appropriate Waste Segregation	Appropriate Disposal of Waste
	a. Segregate biodegradable from biodegradable as compost formation will take longer when mixed. (Campbell, 2008) .	b. Dispose individual trash bins and use centralized trash bins c. Use properly labeled trash bins (Chawla et al; 2017) .
	d. In medical imaging, explore opportunities for sending back e-waste to vendors for re-use (Chawla et al; 2017)	e. Use properly labeled trash bins (Chawla et al; 2017) .
	f. Minimize use of radio-active materials and generation of bio-hazard or radioactive waste (Chawla et al; 2017)	

Reed C, Bahr Mel. Sustainable Pharmaceutical Packaging. Supplement to Pharmaceutical Engineering. 2016 August. Available from: http://www.mgsmachine.com/wp-content/uploads/2016/08/SO13_Pkg_Suppl_Reed.pdf

Campbell J. Creating an environmentally friendly pharmacy. J Pharmacy Practice. 2008 April. [pharmacygateway.ca Available from http://www.algonquin-eco-watch.com/reference-material/Pharmaceuticals%20in%20Water.pdf](http://www.algonquin-eco-watch.com/reference-material/Pharmaceuticals%20in%20Water.pdf)

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	Change work place behaviours and practices towards energy savings	Engage with Suppliers and Stakeholders
Energy Savings	Energy reduction campaigns to continue to promote basic “turn it off” and “unplug it” behaviours for equipment. <i>(Prism Engineering; Hospital Behaviour Change Opportunities Study, 2014).</i>	Engage with suppliers to identify energy-saving strategies like the use of motion sensors <i>(Campbell, 2008).</i>
	Installation of motion sensor lights- The Sodexo Café at VGH and COKE installed sensor lights to reduce energy consumption in refrigeration <i>(Prism Engineering; Hospital Behaviour Change Opportunities Study, 2014).</i>	Engage a regional or provincial consolidated strategy with specific actions to achieve energy reduction and other conservation goals <i>(Prism Engineering; Hospital Behaviour Change Opportunities Study, 2014).</i>
	Replace conventional light bulbs with motion sensitive LED <i>(Chawla et al; 2017).</i>	
	Utilize projectors and computers with auto shutdown feature <i>(Chawla et al; 2017).</i>	
	Switch off air-conditioners when the facility is not in use - <i>(Chawla et al; 2017).</i>	
	Teleconferencing or virtual rounds whenever possible – <i>(Chawla et al; 2017).</i>	
	Purchase energy-efficient appliances - fridge, microwave, etc - <i>(Chawla et al; 2017).</i>	

Campbell J. Creating an environmentally friendly pharmacy. J Pharmacy Practice. 2008 April. pharmacygateway.ca Available from <http://www.algonquin-eco-watch.com/reference-material/Pharmaceuticals%20in%20Water.pdf>

Chawla A, Chinchure D, Marchinkow LO, Munk PL, Peh WC. Greening the Radiology Department: Not a Big Mountain to Climb. Can Assoc Radiol J 68 (3), 234-236. 2017 May 11. Available from [http://www.carjonline.org/article/S0846-5371\(16\)30155-3/fulltext](http://www.carjonline.org/article/S0846-5371(16)30155-3/fulltext)

Prism Engineering. Saving Energy in Hospitals: Hospital Behaviour Change Opportunities Study. A study of Behaviour Change Opportunities by Department. 2014 April 30. Prismengineering.com. Available from <https://bcgreencare.ca/system/files/resource-files/Prism-Hospital-Behaviour-Opportunities-Study%20%282%29.pdf>

Next Steps and Conclusion

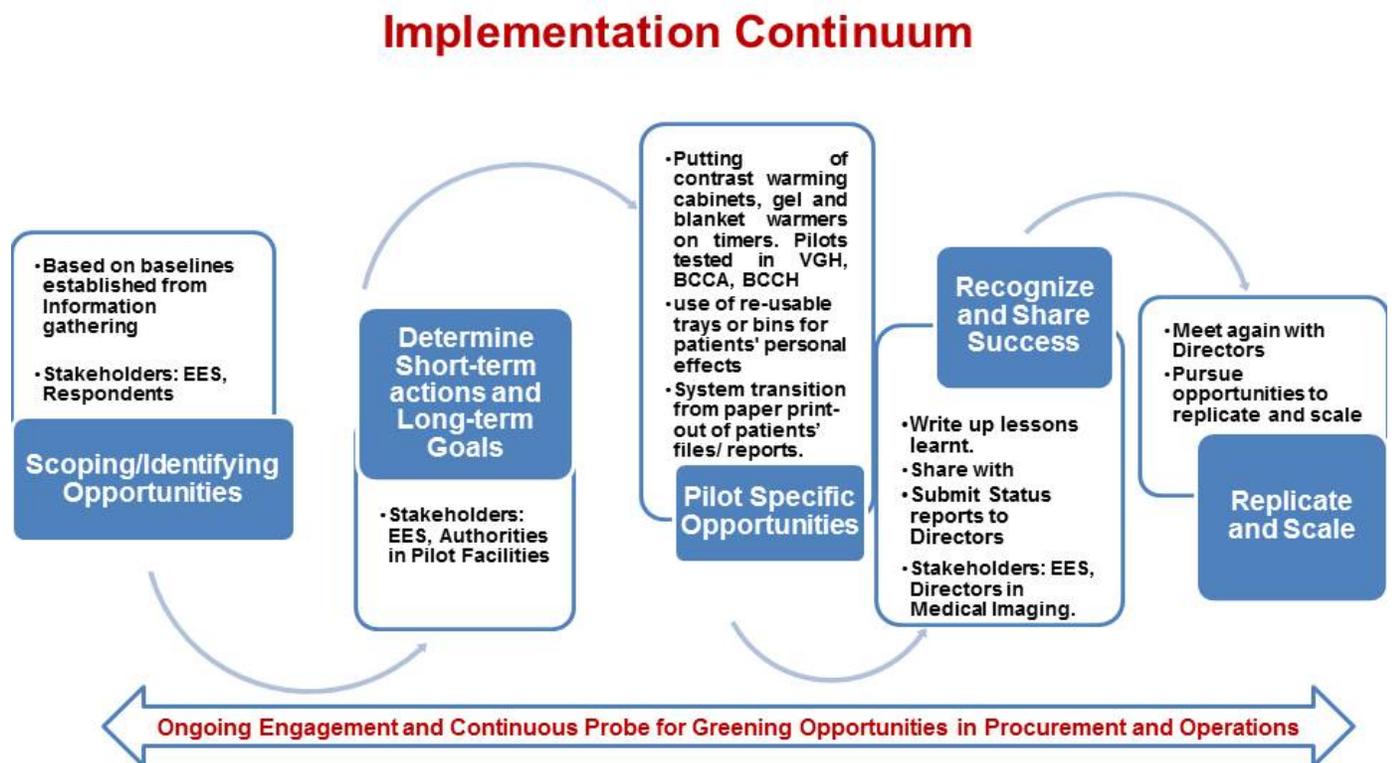
Implementation Continuum

As the information gathering phase of this project pans out, the respondents interviewed in medical imaging departments across the enrolled facilities are fed back with identified opportunities and reports on the project and feedback on possible pilot projects worth exploring are collated. A few low-hanging projects have been identified already. Examples are putting of contrast warming cabinets, gel and blanket warmers on timers. This will be piloted in some sites including Vancouver General Hospital, BC Cancer Agency and BC Children Hospital. Another is use of re-usable trays or bins for patients' personal effects and

washing the bins/trays used for patient clothes. This replaces 'save a day' trays in BC Cancer Agency. Another is a department-wide system transition from paper print-out to digital communications of patients' files and reports.

Figure 1.7. below shows an implementation continuum which represents the way forward on this project and consists of ongoing engagements and continuous probe for greening opportunities in procurement and operations in medical imaging departments in BC Lower Mainland Health Organizations.

Figure 1.7.



Conclusion

This project brings to light the potential to reduce material and energy waste generated from operations in medical imaging departments. It presents a rationale for action in reducing the risks to human health and protecting the wider environment from the impact of operations in medical imaging.

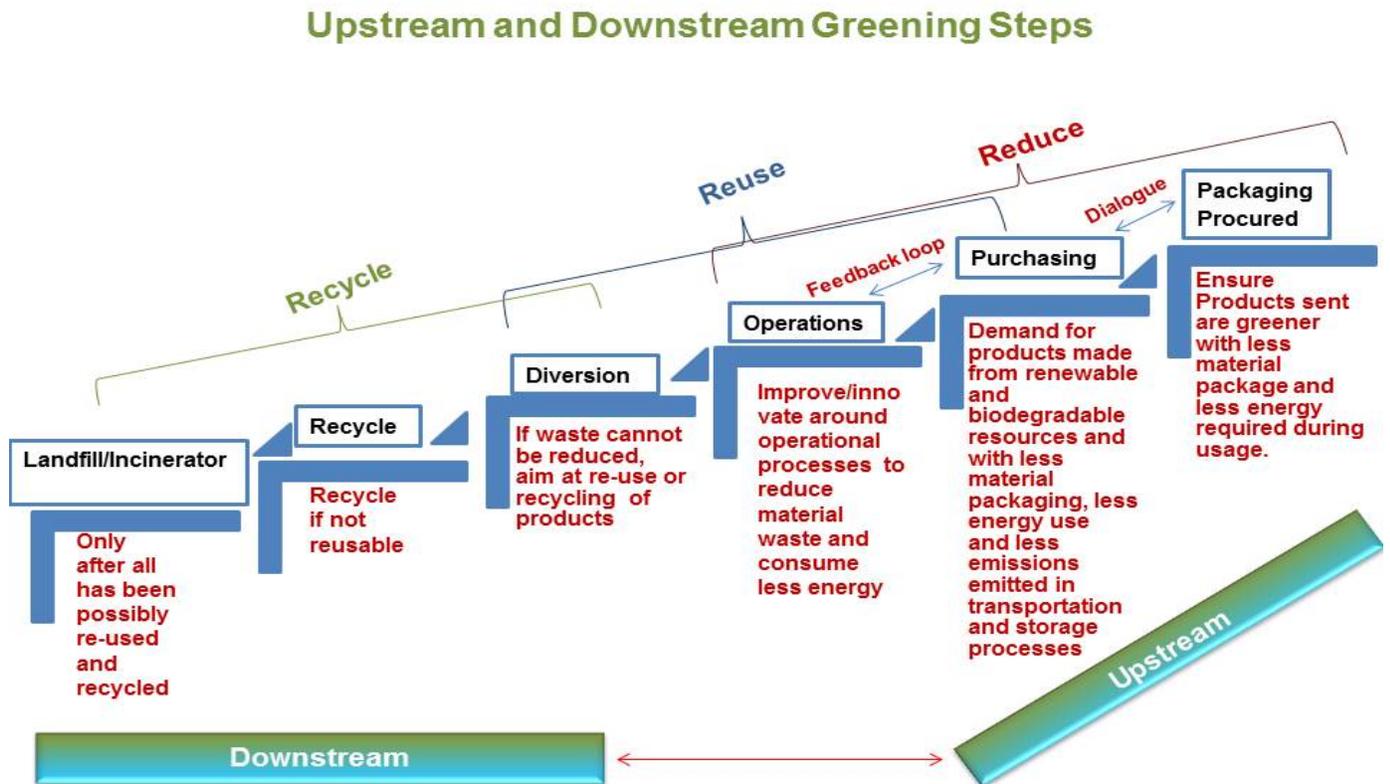
The findings revealed gaps and challenges in current practices and uncharted environmental opportunities that can be explored in greening procurement, operations and energy consumption, as well as waste diversion and disposal practices in medical imaging. Moreover, it was gleaned that there is a need to focus on reducing packaging waste, especially, from procurement since the bulk of the material waste

generated in medical imaging is from packaging. This places a great emphasis on intervening on the supplier-engagement angle which may have to be done through a high-level administration involvement.

One next step could include a workshop that brings together purchasing groups, product vendors and waste disposal vendors including recyclers and waste-end users to deliberate on green purchasing opportunities and generate feedback for manufacturers and procurement stakeholders.

Figure 1.8. below highlights additional upstream and downstream actions that could be taken by stakeholders in a medical imaging greening efforts.

Figure 1.8.



Furthermore, the project presents a call for environmental consciousness to be integrated into procurement and operational policies across medical imaging departments in the Lower Mainland Health Organizations. It offers a number of lessons; one of which is the depth of

green opportunities and measures shared by staff in medical imaging and which speak to their positive attitudes and behaviours to advancing environmental consciousness in their unit operations if such initiatives are provided a system-facilitated platform to thrive.

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