



NSW
Circular

Plastics in Healthcare:

A Circular Economy Transition Plan

OCTOBER 2021

Acknowledgement to Aboriginal people

We acknowledge the traditional custodians of Country and pay our respects to Elders past, present and emerging. We recognise that our built environment and activities are on Aboriginal land and commit ourselves to thoughtful, inclusive and respectful ongoing management of these places.

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Executive Summary

Building a Circular Economy in Australian hospitals: Turning clinical plastic waste into revenue & jobs

Waste audits in Australian and UK hospitals suggest that between 40-60% of waste going into clinical waste streams is non-clinical, of which substantial amounts are potentially recyclable.¹

NSW Circular's first *Circular Supply Chain Alliance* - **Hospital Plastics** targeted clinical hospital plastics (Polypropylene (PP) and Polyethylene (PE)) and the development of a new sustainable supply chain for those plastics that will reduce waste to landfill and generate new economic opportunities by keeping resources in the market longer. The Project was formed with [NSW Circular](#), [St Vincent's Hospital Sydney](#), [Allmould Plastics Group](#), and [University of New South Wales](#), with input from Reference Group members²:

Key Outcomes

- 1 The Project collected over 80,000 pieces of waste plastic over a 3 months from a single hospital (196 beds) - **almost equal to the total amount of plastic food packaging collected in litter clean-ups across Australia in 2018-19.**³
- 2 The Project collected **205kgs of plastic - equal to the weight of 41,000 plastic bags** which were included in recycled products:
 - a. 1,500 roller door wheels - enough to equip 500 garage doors; and
 - b. 7400 building industry grommets & packers deployed across Australian sites.
- 3 The Project included selected clinical areas in the hospital, which accounted for **28% of all ampoules and 11% of all needle caps** used in the hospital. If the scheme was expanded to cover all clinical use of these two items alone, this would recover **nearly 2 million pieces** of plastic a year from this one hospital, weighing over 4 tonnes a year.
- 4 The collection of just these two items across the NSW public health system could **save nearly 70m pieces of plastic from landfill amounting to 150 tonnes and generate savings of \$150,000 each year.** Increasing the volume of plastics collected to 1080 tonnes each year would **create 10 new ongoing jobs in local plastics recycling** to manage the materials being repurposed⁴.
- 5 Moving beyond these two items, **if the estimated 40-60% of recyclable waste currently going into clinical waste streams was recovered, there are potential savings of \$2-3m a year across the NSW Health system that could be reinvested into patient care.** This amount would, for example, free up resources to **hire an additional 40 nurses.** If this additional 2,000-3,000 tonnes of diverted waste was high quality plastic similar to that collected through the Project, this could also potentially generate an estimated 19-29 jobs in plastics recycling.⁵

1 McGain et al, An audit of potentially recyclable waste from anaesthetic practice, *Anaesthesia and Intensive Care*, Vol. 37, No. 5, September 2009, pp. 820-823; McGain et al, An audit of intensive care unit recyclable waste, *Anaesthesia*, 2009, Vol 64, pp 1299-1302; Runcie, H., Sort your waste! An audit on the use of clinical waste bins and its implications, *Future Healthcare Journal*, Vol. 5, No. 3, Oct 2018, pp. 203-206; Hutchins et al, Coming round to recycling, *BMJ* 28 March 2009, Vol. 338, pp. 746-748.

2 Reference Group Members See Appendix 1.

3 World Wildlife Fund, *Plastic Revolution to Reality*, Jul 2020

4 AllMould Plastics requires PE & PP feedstock capacity of 1080 tonnes to support 10 FTE

5 Based on NSW Circular analysis and estimates by partners in the Project.

EXECUTIVE SUMMARY

Impact and benefits to NSW

The *Circular Supply Chain Alliance - Hospital Plastics* demonstrated the significant scale-up potential for clean stream uncontaminated plastic hospital waste in NSW that would create jobs, catalyse new local manufacturing, reduce carbon and avert high-quality plastic resources from landfill.

It concluded that it is possible to extract value and design out waste without compromising health or safety in complex hospital environments. The Project demonstrates how even small-scale projects like this can catalyse longer-term supply circular supply chains, and with it new jobs and economic opportunities. As a direct result of this Project:

Jobs

The regional business partner Allmould Plastics Group is now negotiating with waste service companies and hospitals to increase its PE and PP feedstock capacity to 1080 tonnes. This will enable 10 full-time employees and support a multi-million dollar investment in plant upgrades. This indicates the ready potential for further job generation, given the Project was focused on a small percentage of the total PE plastics used in clinical settings. In addition, recovering just 40-60% of recyclable clinical waste can create \$2-3m annual savings across the NSW Health system and if reinvested back into patient care could hire, for example, an additional 40 nurses.

Carbon reduction

Recycled PP recovered from this Project was used to make new products with a carbon footprint 17 per cent smaller than if the same products were made using virgin plastic.⁶

Scaling & Meeting NSW Plastics Action Plan 2021

New partnerships have been established to scale this Project. [Hunter New England Local Health Districts](#) and [Northern Sydney Local Health District](#) have signed MOUs with NSW Circular to establish new Circular Supply Chains for hospitals. This Project is designed to support all NSW hospitals in meeting the [NSW Plastics Action Plan 2021](#) targets of an 80 per cent recovery rate of resources from all waste streams by 2030. Additionally, Healthshare NSW, a member of the program reference group, is now establishing programs to recycle Personal Protective Equipment (PPE) and filter microplastics from water in NSW public hospitals. NSW Circular will support this work.

Research & Industry Collaboration

The Project identified 13 key problems to be solved by researchers, industry and government as it seeks to extract value from hospital clinical single-use plastic products and address barriers in order to effectively scale the Project outcomes. These challenges are in three main areas and are common to many sectors transitioning to the circular economy:

Transport Options to reduce transport costs & carbon

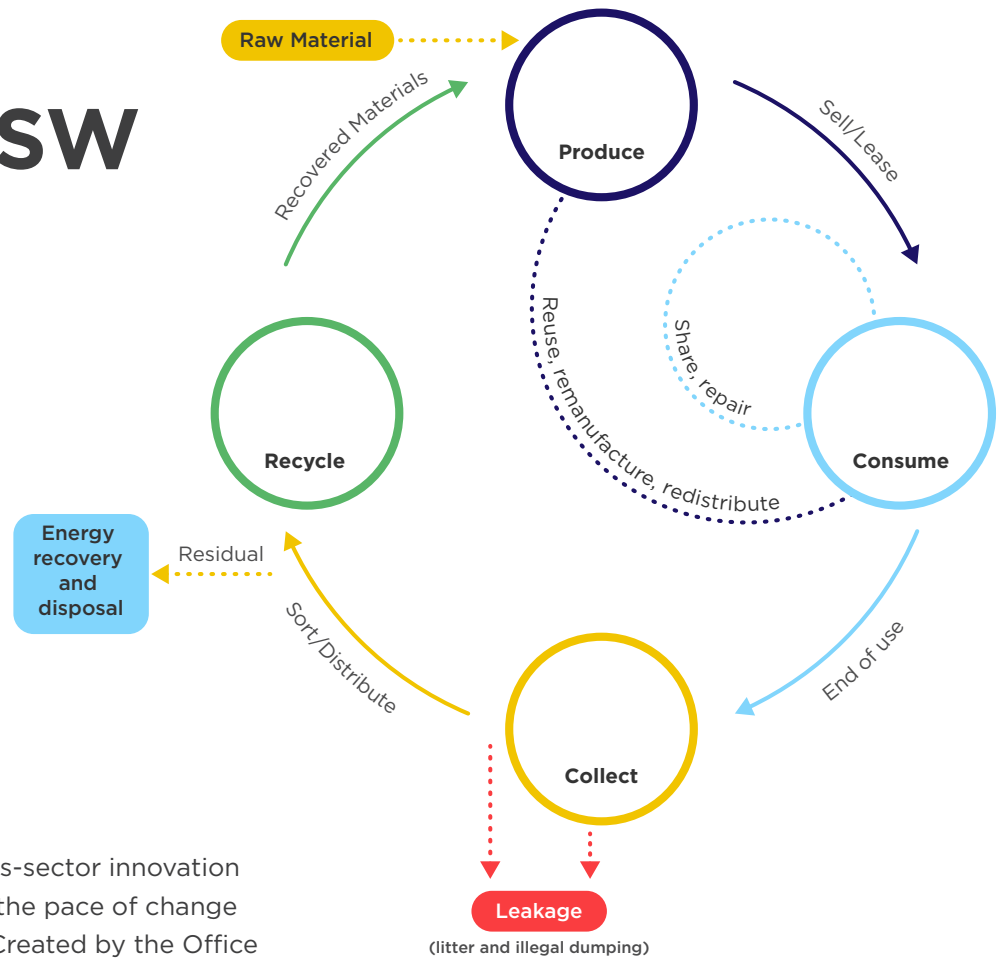
Behavioural change Customer journeys, education and training

Design Reducing waste volume, contamination & handling costs

This Program has applications across the Australian healthcare sector. NSW Circular encourages any hospital or medical centre to apply these approaches, to use our Playbook and reach out to us for support and research to achieve a Circular Economy future.

6 Life-cycle Assessment Study of Polypropylene in Australia (2021). Sajjad Mahmoudi, Farshid Pahlevani, Veena Sahajwalla, Centre for Sustainable Materials Research and Technology, SMaRT@UNSW, School of Materials Science and Engineering, UNSW Sydney.

About NSW Circular



NSW Circular is a unique cross-sector innovation network set up to accelerate the pace of change towards a circular economy. Created by the Office of NSW Chief Scientist & Engineer and now part of Invest NSW, we are hosted by UNSW. NSW Circular empowers government, industry and people to transition to a circular economy through impactful research and collaborations.

Mission to fast-track the transition to a circular economy by:

- Providing transparent and open circular economy data to the market
- Helping to deliver new circular economy markets, infrastructure and services
- Working collaboratively with industry government & researchers to remove barriers and scale the circular economy
- Empowering people to promote circular behaviours and change

NSW Circular has an Australian-leading collaboration platform bringing together research with industry and government to enable organisations to remove barriers and unlock the \$2 trillion circular economy potential in Australia.

NSW Waste and Sustainability Materials Strategy 2041 ⁷

The Circular Economy is a systems change that requires many technical and non-technical problems to be solved. We are working to remove barriers across finance, economics, infrastructure, markets, policy, data, procurement and policy. Our three strategic focus areas are *Circular Economics & Research*, catalysing new *Circular Supply Chain Alliances*, and *Collaboration* through our unique industry, government and research collaboration framework.

The Circular Economy is the new economic framework that enables economic growth in a resource-constrained future. It takes a different approach to materials management - designing out waste and promoting reuse and recycling. Keeping materials in the economy longer extracts more value, generates jobs and promotes regenerative systems that can protect biodiversity and reduce carbon.

The Opportunity

NSW public hospitals

This Project represents a microcosm of the NSW healthcare system. From just a small fraction of plastic waste production, genuine value was established. It is estimated that the collection of even just needle caps and ampoules across the NSW public health system would save nearly 70M pieces of plastic from landfill amounting to 150 tonnes and generate savings of \$150,000 each year.

NSW public hospitals use nearly

38 million syringes a year

resulting in an estimated

57 tonnes of needle caps

put into clinical waste.

By comparison, the St Vincent's three-month trial included only 300,000 syringes.

Waste audits have found

as much as 60%

of material found in clinical waste

is non-clinical

and potentially suitable to be

recycled

for re-manufacturing into new products.

Moving beyond these two items, if we can recover the estimated 40-60% of recyclable waste currently going into clinical waste streams that don't need to be there, we could see savings of \$2-3m a year across the NSW Health system that could be reinvested into patient care. This amount would, for example, free up resources to hire an additional 40 nurses.

Public healthcare in NSW is reported to cost

\$16 million

annually, a significant proportion of which is for clinical waste.

The collection of just needle caps and ampoules

(the products collected in the demonstration project)

could save the NSW public health system nearly

70 million

pieces of plastic from landfill amounting to

150 tonnes and generate savings of

savings of

\$150,000 each year.

Detailed Outcomes:

Circular Supply Chain Alliance Hospital plastics

The purpose of the Circular Supply Chain Alliance - Hospital Plastics program was to design and test a circular economy model in a clinical setting at St Vincent's Hospital. It provided the opportunity to understand the limitations, barriers and potential opportunities from a different approach to clinical waste management. The outcome has been to increase the knowledge base about how to change practices in healthcare settings.

Found that making PP granules from plastic waste has a

carbon footprint 94% smaller

than producing PP granules out of virgin materials.

Virgin material processed into plastic granules for manufacturing in Australia travels more than

19,000km before reaching our shores.

THE NSW CIRCULAR SUPPLY CHAIN ALLIANCE HOSPITAL PLASTICS DEMONSTRATION PROJECT:

Diverted

205kg

of plastic from landfill

Sorted

80,000

pieces of plastic of recycling

Engaged

8 hours

per week of volunteer labour

using 16% recycled

polypropylene plastic in manufacturing reduced the

carbon footprint 17%

in comparison to those made from

100% virgin materials.

Identified potential

recurrent savings

to the hospital total waste bill of at least

\$55,000.

The Circular Supply Chain Alliance Hospital Plastics Program

- Diverted 205.2kgs of clinical plastics from landfill and incineration in a three month period, the equivalent of taking 41,000 plastic bags out of circulation, including:
 - › 157.7kgs of Polyethylene (PE) ampoules
 - › 47.5kg of Polypropylene (PP) needle caps
- The Project collected over 80,000 pieces of waste plastic over a 3 months from a single hospital (196 beds) - almost equal to the total amount of plastic food packaging collected in litter clean-ups across Australia in 2018-19.⁸
- The needles and ampoules collected across just 5 hospital wards, 9 operating theatres, a day theatre and an outpatient site, represented a recovery rate of:
 - › 28 per cent (157.7kgs) of total Polyethylene (PE) ampoules used in the hospital over the three month project
 - › 11 per cent (47.5kgs) of total Polypropylene (PP) needle caps used in the hospital over the three-month project
- If the scheme was expanded to cover all clinical use of these two items alone, this would recover nearly 2 million pieces of plastic a year from this one hospital, weighing more than 4 tonnes a year.
- Remanufactured diverted clinical plastics into:
 - › 1500 roller door wheels - enough to equip 500 garage doors
 - › 7400 building industry grommets & packers (5400 grommets and 2000 packers) deployed across Australian sites
- Found using 16 per cent recycled polypropylene in its manufacturing reduced by 17 per cent the carbon footprint in comparison to using 100 virgin materials.⁹
- Conservative economic assessment identified an annual \$55,000 savings in the total waste bill¹⁰ - the equivalent of a first year enrolled nurse's base salary¹¹. If only needle caps and ampoules for recycling - the hospital would save \$19,000 in its waste bill.
- Reduced the transport footprint of the recycled plastic pellets by at least 19,000km in comparison to virgin plastic
- Introduced a collection and transport service for in-scope products
- Succeeded in processing waste streams back into a materials for reuse
- Resulted in design and trial manufacturing of new products from the recycled material that met industry standards and quality assurance tests
- Changed the behaviour of staff by engaging 14 volunteers including hospital and industry staff who donated an estimated eight hours collectively per week to manage and promote the Project.

St Vincent's Hospital is a tertiary referral hospital for highly complex services. The outcomes here highlight the fact recycling can be successfully implemented in a complex hospital setting.

8 World Wildlife Fund, Plastic Revolution to Reality, Jul 2020

9 Life-cycle Assessment Study of Polypropylene in Australia, prepared by University of NSW SMaRT Centre on behalf of NSW Circular. See Appendix 1.

10 If the hospital was to reduce its total waste production by 15 per cent. Calculation based on St Vincent's Hospital data.

11 https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/1B2021_006.pdf 1 4th year registered nurse @\$75K

Circular Research & Industry Challenges



To realise the Circular Economy potential for NSW hospitals, research is essential and urgently needed along with deeper collaboration between researchers, industry and government.

This report found the key challenges facing our hospitals as they seek to leverage the economic and environmental benefits of the circular economy are design and change management - challenges also familiar to other sectors transitioning to a circular economy.

Hospital Plastics Alliance: 13 challenges

Transport: Options to reduce transport costs & carbon

Challenge 1: Mobile granulation and baling systems

Challenge 2: Co-locate granulation, pelletisation and manufacturing lines

Challenge 3: Innovate the process to eliminate either granulation or pelletisation

Challenge 4: On-site processing capability to recycle and manufacture products at hospital sites.

Behavioural change: Customer journeys, Education and training

Challenge 5: Customer journey mapping

Challenge 6: Circular economy design in wards for safe and easy reuse and recycling

Challenge 7: Information and engagement.

Design: Reducing waste volume, contamination & handling costs

Challenge 8: Loading docks and waste pathways designed to enable uncontaminated clean resource recovery, prevent system pinch points and reduce cost

Challenge 9: Loading dock redesign solution for multiple waste streams

Challenge 10: Mechanical sorting that can manage small items

Challenge 11: New technology such as blockchain or AI tracking in the medical products supply chain for assurance and material type

Challenge 12: An application solution linked to a licensed data feed that would identify product materials for consumers to dispose of products correctly

Challenge 13: Circular economy product design guidelines.

For more information about these challenges, see **Plastics in Healthcare: The St Vincent's Hospital case study**

Resources

The outputs of this Circular Supply Chain Alliance program are useful resources for hospitals:

- 1** The *Circular Supply Chain Alliance - Hospital Plastics Summary* of the economic and jobs opportunities of new circular recycling practices to capture clean hospital waste streams across the NSW healthcare system.
- 2** The *Circular Supply Chain Alliance - Hospital Plastics Case Study & Appendices* documenting new circular recycling practices that were put in place to capture clean hospital waste streams, connecting this waste with a commercial manufacturing company to produce recycled components from the hospital waste.
- 3** A **Playbook** designed for hospitals across Australia to implement and replicate. It provides evidence on the opportunities and barriers and includes recommendations on the best approaches to recycling Polyethylene (PE) and Polypropylene (PP) single-use uncontaminated clinical hospital plastics.
- 4** A **Spotlight Report** by NSW Circular's Chief Circular Economist.

Ultimately NSW Circular would like to see all NSW hospitals, including the State's 220 public hospitals, transitioning to a circular economy. This Summary, Case Study, Playbook, and Spotlight report are designed to help on that journey.





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