To the:

Ministry for the Environment

On:

Reducing the Impact of Plastics on Our Environment
Moving Away from Hard-to-Recycle and Single-Use Items

4 December 2020

Submission by:

PLASTICS NZ
EPS SECTOR GROUP

Industry Sector Group
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This submission is on behalf of the New Zealand plastics industry and its customers. It is also specifically endorsed by the following companies:

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1. Introduction:

Plastics New Zealand is the trade organisation representing the New Zealand plastics industry. Our Membership comprises over 185 businesses including manufacturers, suppliers, recyclers (reprocessors), brand-owners and consultants to the industry. The industry has a broad range of company sizes from very large corporates to small enterprises.

New Zealand's Expanded Polystyrene Sector Group sits under the umbrella of Plastics NZ. This group is made up of the EPS manufacturers and suppliers of polystyrene raw materials.

The proposed ban of all EPS packaging by 2025 has considerable impact on the NZ EPS packaging manufacturers, their customers, and those importing product utilising EPS packaging. While this submission is on behalf of all of those within this system, we have encouraged all impacted parties to make their own submissions so they can share specifics of the commercial and economic impacts, the impacts on NZ jobs, real-world case studies showing the testing of alternatives to EPS, and other information showing the impacts of the proposed ban.

Plastics NZ and our EPS Sector Group welcome the opportunity to discuss our submission with MfE in more detail and will also engage directly with the relevant Ministers regarding the proposal to ban all EPS packaging by 2025.

Please see the Plastics NZ general submission for a broader discussion of all proposals in the consultation.

2. Summary:

This submission is focused only on the EPS phase-out/ban. The Sector Group does not manufacture any of the single-use EPS takeaway containers, beverage containers and tableware proposed to be phased out. As these materials commonly become litter and are problematic within the NZ kerbside recycling system, the Sector Group does not oppose the phase-out of these items. There are viable alternatives for all these single-use products already being used within New Zealand.

The Sector Group strongly opposes a blanket ban of all EPS packaging by 2025. EPS is an exceptional material across several key packaging performance functions:

- Thermal and insulative properties required for cold-chain supply lines (e.g seafood, pharmaceuticals, medical)
- Impact properties required for product protection (e.g. shellfish, lab samples, whiteware, large electronics goods)
- Vibration damping properties (e.g. live seafood, biologics)
- Low resource use (2% plastic, 98% air) so lower carbon footprint to manufacture than alternatives[1]
- Extremely light weight providing fuel efficiency in transport and reduced emissions over alternatives

Under the Waste Minimisation Act 2008 Section 23 (2)(b) the Minister for the Environment must not recommend the control or prohibition of the manufacture or sale of products containing specified materials (Section 23 (1)(b)) unless a reasonably practicable alternative to the specified material is available. Real-world testing of the alleged alternatives to EPS has shown that they do not meet the high-level requirements of cold-chain supply lines and shipment of heavy products. **A blanket ban must therefore not be announced by the Minister as practicable alternatives do not exist.**

[1] Reginald B.H. Tan, Hsien H. Khoo, Life cycle assessment of EPS and CPB inserts: design considerations and end of life scenarios, Journal of Environmental Management, Volume 74, Issue 3, 2005, Pages 195-205, ISSN 0301-4797, https://doi.org/10.1016/j.jenvman.2004.09.003

While New Zealand needs to change its relationship with plastics this needs to be carried out in an evidence-based manner that avoids unintended consequences and provides overall reduction in environmental harm. The current pathway is very much led by voter-opinion and social media science. This limited perspective will ensure unintended impacts across the NZ environment and our economy.

Re-assessment of the options, as provided in this submission, indicates that product stewardship would provide a far more effective method of handling the EPS packaging used in cold-chain supply lines and for protective packaging. The EPS manufacturers are already recycling EPS and are ready to do more. Formalised product stewardship would enable the key stakeholders across the wider system, including those importing protective packaging in the retail and medical sectors, to become part of the solution.

Based off all of the information gathered, and the lack of viable alternatives for these specific EPS packaging applications we have a single set of recommendations.

Recommendations:

Stop pursuing mandatory phase-out of all EPS Packaging. There are no viable alternatives to the EPS used in cold-chain supply lines and for protective packaging of heavier products.

Investigate formalised product stewardship for this EPS packaging. The packaging is already included under the scope of the 'plastic packaging' priority product category.

Support businesses to investigate reuse systems for local cold chain

3. Problem Description

Q1: Do you agree with the description in this document of the problems with hard-to-recycle plastic packaging and single-use plastic items? If not, why?

For specific types of EPS packaging critical to the NZ economy – no we do not agree.

3.1. Designation of all EPS as 'difficult to recycle'

The consultation document presents an oversimplified, and narrow view of the problem. This is leading to incorrect analysis in relation to the EPS packaging used in cold-chain supply lines and as protective packaging.

Rigid polystyrene forms a very low percentage of kerbside recycling in New Zealand. This low percentage makes it uneconomical to collect and recycle via kerbside. The shortcomings of the NZ waste system also mean that most EPS containers and takeaway packaging end up in landfill or as litter. These two things, in our opinion, are the primary reasons polystyrene has been labelled as 'difficult to recycle' under the Rethinking Plastics[2] report. There is no problem with finding offshore markets for polystyrene if the material is separated and in enough quantity. It is a valuable material with many uses. Koolfoam Industries, one of our members, sent two 40-foot containers of compacted EPS (17 tonnes), to offshore recycling in the last 6 months. Collection and transport are also referenced as the biggest challenges. It is quite easy, and relatively low cost, to compact EPS and then transport it.

[2] Rethinking Plastics in Aotearoa New Zealand, 2019, Office of the Prime Minister's Chief Science Advisor, https://www.pmcsa.ac.nz/topics/rethinking-plastics/

EPS passing through the hands of industry and remaining in New Zealand is often recycled. The industry has actively been recycling EPS since the 1980s. For example, in 2019 the Sector Group diverted over 150,000 cubic metres of EPS from landfill, recycling over 1,200 tonnes. A large portion of this went back into NZ made EPS products rather than offshore. This does not include the amount collected, compacted, and sent offshore for recycling overseas by the waste management companies, and organisations like Abilities Group. NZ EPS manufacturers are also taking back construction products at end of life for recycling.

There is plenty of scope for Extended Producer Responsibility (EPR) or product stewardship for these packaging materials. The local EPS Manufacturers have been looking into this for several years. All companies within the Sector Group run take-back schemes for their construction products and most take post-consumer EPS if asked. Some are actively pursuing relationships with retailers to increase the take-back and recycling of post-consumer packaging (see Case Study 1).

The main reason that the activities of the industry are not broadly known are due largely to Government action. The Sector Group had active plans in place to launch an EPS recycling media campaign on the 12th of December 2019. This was entirely focused on post-consumer packaging EPS and would have provided information to the public as to where they could take the EPS packaging collected from Christmas presents to recycle it. Expectations were that this would have had great media pickup as it showed the public what to do with something viewed as 'problematic' by many. This campaign was aligned with www.airpop.co.nz which also provides information for businesses and the public on EPS recycling in NZ. The number of collection sites for EPS has increased by 105% over the last 12 months.

On the 8th of December 2019, the Government announced a planned phase-out of polystyrene. This announcement was made with no industry consultation, no understanding of the EPS recycling situation in New Zealand, and indeed no understanding of the scope of what had been proposed. It became quickly apparent that key decision-makers within Government did not understand the scope of 'polystyrene packaging' or the specific reasons it is used as a packaging material. The reputational damage to the EPS manufacturers by this ill-advised announcement led the Sector Group to withdraw from its recycling media campaign.

Case Study 1: Expol Recycling Cubes

Expol has made a commitment to the environment and take responsible manufacturing seriously. They are focused on a true closed-loop recycling process – 75% of the products made use recycled content and they have plans and concepts in place to do even better.

Expol operates seven recycling plants nationwide that recycle 350 tonnes of polystyrene a year. That's 2,800 cubic metres a month and Expol expects to steadily increase this volume. They actively collect EPS waste from their customers and have been known to proactively clean up fly-tipped EPS waste[3].

Expol has also created an ever-expanding network of collection points for EPS with 25 Expol Residential Polystyrene Recycling Cubes installed at retailers throughout New Zealand from Auckland to Dunedin[4]. These cubes are specifically for the collection of consumer residential polystyrene waste (i.e. packaging). Expol then converts the collected materials into new and useful products.

[3] https://www.expol.co.nz/blog/expol-extra-mile-environment/
[4] www.expol.co.nz/enviro

3.2. EPS as a 'major source of pollution'

EPS used in cold-chain supply lines and as protective packaging is not accepted in kerbside recycling, and rightly so. In the absence of a nation-wide stewardship scheme, this means that a lot of the packaging passing through the hands of the public ends up in landfill or as litter. NZ also has a problem with fly-tipping of EPS waste within the construction sector. This problem is something that the EPS Sector Group has been addressing with its customers for years through education and take-back schemes. Companies also clean up this waste when notified of it, even though it is often not from their own products. Formalised products stewardship would further help resolve this issue.

Page 17 of the consultation references that *foamed plastic containers, such as EPS, make up around 6.2% of litter on NZ beaches*. This data, extracted from the Litter Intelligence Project[5], combines all foamed plastics together including EPS takeaway containers, construction EPS, packaging, foam sponge, ear plugs, buoys, 'other' foamed plastic and unidentifiable foamed fragments. It cannot therefore be used as a measure of how much litter might be removed by banning EPS packaging.

Review of the most recent data from 1st November 2019 to 1st November 2020 shows that EPS cups and food packaging made up 0.52% of total litter by count and 0.02% by weight. Construction & packaging EPS are aggregated and together make up 4.74% of total litter by count and 0.16% by weight. Given the fly-tipping issue it is likely that at least half of this latter category is illegally dumped construction waste. A ban on EPS packaging is therefore likely to remove less than 3% of litter by count and 0.1% of weight. Increased education around recycling options, combined with product stewardship that would eliminate, or greatly reduce, fly-tipping would be far more effective.

A ban on any material is extremely unlikely to change poor public behaviours and reduce the amount of litter. This EPS packaging would be replaced with other packaging just as likely to be littered or leaked to the environment. Further to this is a lack of official enforcement by councils and government to tackle these issues. Where is the work-programme to prevent leakage from waste management systems, to enforce littering bylaws, and to clean-up existing leakage from substandard landfill sites? The root causes of the leakage and littering are not being addressed. We are blaming the material rather than our management of it and poor behaviours. Blaming the material is akin to blaming a chainsaw for cutting down a protected tree, rather than prosecuting the person running it.

3.3. EPS and Climate Change

The consultation document draws some erroneous conclusions regarding plastics and climate change, particularly in regard to EPS.

The statement *The plastics industry's consumption of oil is projected to increase to 20 per cent of total annual oil production by 2025* is based off a report from the World Economic Forum[6] which in turn references the IEA, World Energy Outlook 2014[7] report. As the worlds understanding of issues around climate change and plastics have increased, there have been significant changes over the last five years. Review of more recent reports indicates that plastics are approximately 44% of petrochemicals market with the rest being nitrogen fertilisers and other chemical products[8]. Chemical feedstocks are projected to increase from 12% of total oil demand in 2017 to 16% in 2050[9].

[5] Litter Intelligence Citizen Science Program led by Sustainable Coastlines: https://insights.litterintelligence.org/

[6] World Economic Forum 2016 *The New Plastics Economy: Rethinking the future of plastics, Geneva* http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf

[7] IEA (2014), World Energy Outlook 2014, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2014

[8] IEA (2018), The Future of Petrochemicals, IEA, Paris https://www.iea.org/reports/the-future-of-petrochemicals, Figure 2.3

[9] IEA (2018), The Future of Petrochemicals, IEA, Paris, Figure 4.6

With 44% contribution the plastics industry's consumption of oil is therefore approximately 7% of total oil demand in 2050, not 20%.

The claim that *plastics will be responsible for up to 15 per cent of the total 'carbon budget' by 2050* references Geyer, Jambeck and Law (2017)[10]. This report does not discuss this matter. The author perhaps meant to reference the 2019 *Plastic and Climate*[11] report from CIEL which claims that plastics could reach 10-13% of the carbon budget remaining to ensure temperatures stay at or below a 1.5°C rise. This report obfuscates plastics with petrochemicals calling into question the veracity of the basic data. It also ignores the impact of moving from plastic to alternative materials. Plastic is strong and lightweight. Alternative materials are nearly always thicker and heavier. A report by Franklin Associates in 2018[12] showed that global warming potential would increase two to three times if plastic packaging was switched out for alternative materials.

The situation for EPS Packaging shows even less impact as EPS is 2% plastic and 98% air. This means that it is extremely light weight for the high level of insulation and impact protection it provides. Alternative options, as well as failing to match the performance of EPS, are significantly heavier and have far greater climate impacts. They require more energy during their production, result in higher fuel consumption due to increased weight, and contribute far more to global emissions than EPS.

3.4. Carcinogenic Chemicals in EPS

There is no evidence that EPS is unsafe for human contact, that it causes cancer or other health issues. Polystyrene for food contact applications is highly regulated by the FDA and other regulatory bodies around the world. Testing by the FDA has shown clearly that the amount of styrene remaining in expanded polystyrene (EPS) is extremely low; 47.8 mg/kg vs 10,000 mg/kg safe limit[13].

Page 18 of the consultation document mentions *'concerns about the potential health impacts from the toxins in polystyrene, and the carcinogenic chemicals in EPS and other foamed containers'.* The reference links to the Ellen MacArthur Foundations' 2017 report *The New Plastics Economy: Catalysing Action.* There is zero mention in this report about 'toxins in polystyrene' and 'carcinogenic chemicals in EPS'. The report mentions additives of concern for PVC (vinyl chloride and phthalates) but nothing for EPS[14].

There is often confusion between styrene monomer and polystyrene. They are quite different and have different properties. Styrene is a small molecule, generally in liquid form. Polystyrene is a very large molecule forming solid plastics. While naturally occurring in a number of foods, including cinnamon, beer and strawberries[15], styrene is *reasonably anticipated to be a human carcinogen*

[10] Geyer, Roland & Jambeck, Jenna & Law, Kara. (2017). Production, use, and fate of all plastics ever made. Science Advances. 3. e1700782. 10.1126/sciadv.1700782. https://www.researchgate.net/publication/318567844_Production_use_and_fate_of_all_plastics_ever_made

[11] Plastics & Climate, The hidden costs of a plastic planet, CIEL https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf

[12] Life Cycle Impacts of Plastic Packaging Compared to Substitutes in the United States and Canada, Franklin Associates for ACC, 2018, https://plastics.americanchemistry.com/Reports-and-Publications/LCA-of-Plastic-Packaging-Compared-to-Substitutes.pdf

[13] Updated evaluation of the migration of styrene monomer and oligomers from polystyrene food contact materials to foods and food simulants: file:///C:/Users/Rachel/Downloads/StyrenemigrationPSFCMandfoodsimulantsFoodAddContam2014.pdf

[14] Ellen MacArthur Foundation *The New Plastics Economy: Catalysing Action,* Isle of Wight, 2017, https://www.ellenmacarthurfoundation.org/assets/downloads/New-Plastics-Economy_Catalysing-Action_13-1-17.pdf

[15] The Safety of Styrene in selected foods, https://www.plasticfoodservicefacts.com/wp-content/uploads/2017/10/Safety-of-Styrene.pdf

based on limited evidence of carcinogenicity from studies in humans[16] by the US Department of Health and Human Services. Polystyrene is not considered a carcinogen and as discussed above, is safe for use in food contact packaging. To put this in context wood dust and solar radiation (sunlight) are known to be carcinogenic and UV is *reasonably anticipated to be* a human carcinogen along with a large number of other compounds utilised in everyday products[17].

While we realise this mistake is unintentional it is disappointing to see such a claim in a government consultation document that is being distributed widely throughout New Zealand. This information is false and creates reputational damage for those using EPS packaging. We live in times where misinformation is rife and spreads at dramatic rates. The harm caused by errors such as this should not be underestimated. Real companies, with real employees are impacted.

4. Objectives

Q2: Have we identified the correct objectives? If not, why?

No – the focus is too narrow.

4.1. Main Objective

While the main objective is laudable in intent, the focus is too narrow. The emphasis should be on reducing the environmental and economic impacts of unnecessary waste within the NZ system.

Restricting the objective to 'reducing the amount in use' biases the analysis. While there is a definite need to consider the higher levels of the waste hierarchy, remove unnecessary packaging, and to redesign both our packaging and our system to ensure circularity, the importance and function of good packaging should not be forgotten. Such a narrow focus on only the end-of-life portion of environmental footprint, is likely to lead to increases in food waste or product damage. The loss of the contents of the packaging has a far more significant environmental impact than the packaging itself.

By focusing narrowly on plastics, the proposals almost guarantee increased emissions, particularly in the case of EPS which is significantly lighter than any alleged alternatives.

The assumption that all polystyrene is 'hard-to-recycle' as discussed in Section 2 is also problematic given that EPS is readily recyclable in NZ. Improvement of the collection system is required, something that could be achieved through formalised EPR or product stewardship.

4.2. Secondary Objectives

There is an assumption that changing materials will lower the amount of litter and improve resource management. However, there is nothing in the proposals indicating planned action around litter prevention and behaviour change (e.g. education and enforcement). As plastic pollution is a result of poor waste management systems and/or human behaviour, there will be no reduction from simply changing materials. It will simply morph into a different format.

The 'lower risk of environmental damage' is highly debatable, particularly when considering the EPS packaging used in cold-chain supply lines and protective packaging. Not only do the alternatives use more resources (EPS is 2% plastic and 98% air), but they are more carbon intensive. As the performance of the alternatives is also inferior to EPS, there is a greater risk of increased food

[16] US Department of Health and Human Services 14th *Report on Carcinogens,* 2016, Styrene RoC Profile: https://ntp.niehs.nih.gov/ntp/roc/content/profiles/styrene.pdf
[17] S Department of Health and Human Services 14th *Report on Carcinogens,* 2016, https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html#C

wastage or product loss through damage. When considering all environmental impacts, rather than narrowly focusing on the end of life, EPS is the preferable option for these particular applications.

5. Options for Consideration & Criteria

Q3: Do you agree that these are the correct options to consider? If not, why?

Yes – although an additional option should be added.

The options as presented appear to be the correct ones to consider. However, a ninth option should be added:

Option 9: mandatory agreement with industry and business

An agreement which producers must engage with would ensure a level playing field and participation by all. Specific targets could then be developed collectively with industry and government, ensuring ongoing progress. This has already been proven effective within New Zealand's EPS industry as shown through the Voluntary Accord with the Ministry for the Environment to move away from hexabromocyclododecane (HBCD) flame retardants. The Accord led to an accelerated phase-out of HBCD in NZ polystyrene as soon as was reasonably possible with developments of non-HBCD flame retardants.

Q4: Have we identified the right criteria (including weightings) for evaluating options to shift away from PVC and Polystyrene packaging, oxo-degradable plastics and some single-use items? If not, why?

In part – as overall objective is too narrow in focus, so are the criteria.

As the focus of the main objective is too narrow the 'Effectiveness' criterion is also too narrow. This focuses only on elimination, or significant reduction. The focus of this criterion should be the elimination or reduction in waste ending up in landfill or as litter. The narrow focus of this criterion immediately biases the analysis.

The rest of the criteria are reasonable when considered in the context of the scope. However, in the context of what we feel the objectives should be (see Section 4.1), then the criteria are too narrow.

6. Assessment of the Options - EPS

Q5: Do you agree with our assessment of the options, and our decision to take forward only one option (a mandatory phase-out)? If not, why?

No – the assessment has not been carried out correctly for EPS

There are several issues with the way the assessment has been carried out. The first relates to the criteria used to make the assessment. While the criteria, and the weighting used, are suitable, the decisions have been made without adequate information. The consultation asks questions about the costs and impacts of the proposals. However, significant and inaccurate assumptions on both of these have been made in order to assess the various options.

The second problem with the assessment is the way that phase-outs of entire material categories have been conflated with bans on specific single-use items. Each material phaseout has different effectiveness and costs. The same is likely for each single-use plastic item. This analysis should

therefore have been carried out for each item in the consultation separately as different results are likely for each.

It is also misleading to have an *'? Unknown or no evidence'* score for certain options when the largest unknown factor relates to the costs of the various options; a criterion that has had specific costs applied for all options.

Table 6.1 shows a modified assessment specifically for EPS cold chain and protective packaging. This clearly shows that product stewardship is an effective option for this type of packaging. A mandatory agreement including set targets would be the next option. A mandatory phase-out moves down to 5th equal.

The following changes have been applied. Additional notes on the assessment can be found in Appendix A.

- '? Unknown' score has been changed to 'Minimal'
- Effectiveness is redefined to ask *Will the option advance the elimination or reduction of the packaging material ending up in landfill or littered?* This realigns the analysis to the unbiased objective of eliminating unnecessary waste as outlined in Section 4.1.
- When assessing the options as to whether they are achievable without new legislation, or amending legislation, it is strange to see an assessment of 'somewhat' achievable for voluntary agreements and reduction targets. These are achievable under current legislation. These are therefore changed to 'yes'. New option 9 (mandatory agreement) set as 'no' as we're unsure about this.

Table 6.1: Modified Analysis – EPS Cold Chain & Protective Packaging Only

Assessment criterion	1. Voluntary agreement / pact	2. Reduction targets	3. Labelling requirements	4. Levy / tax	5. Product stewardship	6. Mandatory phase-out	7. Mandatory recycled content	8. No change (ad hoc voluntary action)	9. Mandatory agreement with targets
Effectiveness *(triple weighting)*	Somewhat (1 x 3 = 3)	Somewhat (1 x 3 = 3)	No (-1 x 3 = -3)	Somewhat (1 x 3 = 3)	Yes (2 x 3 = 6)	Yes (2 x 3 = 6)	Somewhat (1 x 3 = 6)	Minimal 0	Yes (2 x 3 = 6)
Cost *(double weighting)*	Somewhat (1 x 2 = 2)	Somewhat (1 x 2 = 2)	No (-1 x 2 = -2)	Somewhat (1 x 2 = 2)	Somewhat (1 x 2 = 2)	No (-1 x 2 = -2)	Minimal 0	Somewhat (1 x 2 = 2)	Somewhat (1 x 2 = 2)
Alignment with strategic direction	Somewhat 1	Somewhat 1	Minimal 0	Somewhat 1	Somewhat 1	Yes 2	Yes 2	Minimal 0	Yes 2
Achievable under current legislation	Yes 2	Yes 2	Yes 2	No -1	Yes 2	Somewhat 1	No -1	Yes 2	No -1
Weighted total score	8	8	-3	5	11	7	7	4	9
Ranking	3rd =	3rd =	9th	7th	1st	5th =	5th =	8th	2nd

Scoring: Yes = 2, Somewhat = 1, Minimal = 0, No = -1

7. Phase Out Hard-To-Recycle Plastics – EPS

Q6: Do you agree with the proposed phase-out of PVC and polystyrene packaging as set out in two stages (by 2023 and 2025)? If not, why?

No – we do not agree with the phaseout of EPS cold chain & protective packaging

Q7: Have we identified the right packaging items that would be covered by a phase-out of PVC and polystyrene packaging? If not, what would you include or leave out and why?

No – the assessment has not been carried out correctly for EPS. See earlier sections and additional detail below.

Following discussions with MfE staff we feel it is important to highlight the critical applications of EPS in the cold-chain and protective packaging supply chains. There are very good reasons that EPS packaging is used. Due to public pressures many companies have tried alternative options with less than satisfactory results (see Section 9). The alternatives often have good marketing 'spin' but when tested in real-world environments fail to meet the stringent requirements.

We also reiterate the incorrect labelling of cold-chain and protective packaging EPS as 'difficult to recycle' as referenced in Section 3.1. We note that the consultation acknowledges on page 38 that there are recyclers in New Zealand who take EPS for recycling. However, we also note that this has been designated 'a solution for recycling EPS used in other sectors, eg, construction'. This is not correct. Many of the NZ EPS manufacturers take post-consumer EPS packaging for recycling. Expol for example are working with a number of retailers to create a national collection network[18] for post-consumer EPS (See Case Study 1).

7.1. Seafood Transportation

New Zealand exported over $1.68 billion of seafood (fish, crustaceans, shellfish etc) in the year to June 2020. Around $0.16 billion was imported in the same timeframe. EPS Packaging is utilised for a large portion of this market for the following reasons:

- EPS has exceptional thermal insulation properties and can maintain safe temperatures over the shipping timeframes. Thermal management and food safety are primary considerations for seafood packaging.
- EPS is waterproof and retains its structural integrity on contact with water, ice or condensation. This is important for palletisation and shipping.
- EPS can be manufactured with or without drain holes depending on the needs of the customers. This ensures leakage is controllable throughout logistics chain.
- EPS dampens vibrations and shock very well. This is critical when shipping live animals such as crustaceans. The animals are also unable to work their claws through the wall of the EPS packaging ensuring injury is prevented (important from animal welfare point of view).
- EPS is extremely lightweight meaning it can be shipped cost-effectively around the world without incurring higher freight costs and emissions than necessary.

The food safety requirements for seafood are strict to minimise and prevent foodborne illness. The most common illness relating to failures in thermal control in seafood is histamine poisoning. This occurs when fish are not handled or chilled appropriately and bacteria convert amino acids into

[18] https://www.expol.co.nz/enviro

biogenic amines[19]. When eaten, these cause allergic symptoms such as rashes and skin inflammation. An example of this occurred in November with Hello Fresh Trevally fillets[20].

The Ministry for Primary Industries (MPI) states that fish should not be exposed to temperatures more than 4.4°C for more than 4 hours after the initial chilling[16]. The *Processing of Seafood Products Operational Guide* also indicates the temperatures in the table below as mandatory requirements[21]. Note the requirement to keep chilled fish products below 4°C and chilled whole fish below 1°C.

HC Spec Table 7: Maximum Critical Preservation (Loadout) Temperatures

Product type	Chilling / Freezing temperature
Shucked pāua intended for canning in New Zealand	6°C
Chilled whole fish	-1°C to 1°C
Chilled fish product	-1°C to 4°C
Frozen fish or fish product (including shellfish)	-18°C
Brine frozen fish	-9°C

Another applicable requirement under the Commercial Slaughter Code of Welfare is that live crabs, rock lobsters (crayfish) and freshwater crayfish (kōura) must be insensible at the time they are killed[22]. This is typically done through chilling the animals to 4°C or less.

7.2. Pharmaceuticals, Veterinary, Science & Medical Sectors

EPS is used extensively for the shipment of pharmaceuticals, biologics, scientific samples, and vaccines. EPS meets the following critical criteria:

- Thermal control to ensure efficacy of medications and vaccines is maintained throughout shipment. Vaccine potency, for example, is reduced every time a vaccine is exposed to an improper condition[23].
- Thermal, vibration and impact control to maintain integrity of biologics.
- EPS is mouldable into the specific shapes required to fully protect and hold breakable items such as glass vials.
- Contact with dry ice does not impact the performance of the EPS (ultra-cold supply chains).
- Under the Ministry of Health's *National Standards for Vaccine Storage and Transportation for Immunisation Providers*[24] EPS is one of only two options for temporary storage of

[19] Ministry for Primary Industries, Food Control Plan Template, Specialist Retail – Fishmonger Safe, https://www.mpi.govt.nz/dmsdocument/11797/direct

[20] https://www.nzherald.co.nz/nz/hello-fresh-food-poisoning-20-more-people-report-symptoms-after-eating-spoiled-fish/MJUJVDPF6FWXI5ZBUV7EZN2B7A/?ref=readmore

[21] Ministry for Primary Industries, Operational Code – Processing of Seafood Products, Section 23.2, page 135, https://www.mpi.govt.nz/dmsdocument/19853-Processing-of-Seafood-Products-Operational-Code

[22] Commercial Slaughter Code of Welfare 2018, Section 6.2. Issued under the Animal Welfare Act 1999. https://www.mpi.govt.nz/dmsdocument/1409/direct

[23] U.S. Department of Health and Human Services Centers for Disease Control and Prevention, *Vaccine Storage and Handling Toolkit,* Pg 49, https://www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf

[24] Ministry of Health, *National Standards for Vaccine Storage and Transportation for Immunisation Providers, 2nd Edition 2019,* https://www.health.govt.nz/system/files/documents/publications/national-standards-for-vaccine-storage-and-transportation-for-immunisation-providers-sep19.pdf

vaccines during refrigerator maintenance or for transport to another provider. This is consistent with the *Vaccine Storage and Handling Toolkit*[25] put out by the CDC in the USA (updated Nov 2020 for Covid-19)

Given the global pandemic, it is worth noting that much of the Covid-19 vaccine will be shipped around the world in packaging systems utilising EPS. Pfizer has already indicated their decision to use EPS as part of their system to ensure adequate protection of the very thermally sensitive vaccine[26].

While exemptions would allow critical pharmaceuticals to still be shipped, this does not eliminate the fact that EPS would be coming into the NZ system. A blanket ban would leave NZ with no method of dealing with this substantial amount of packaging material. Following a product stewardship route, and building up the recycling capability of the industry, is a far better approach.

7.3. Electronic Products & Machinery

New Zealand imports more than $15.8 billion in machinery and other electrical goods[27]. It is likely that a significant part of this imported product utilises EPS as protective packaging.
EPS is not a popular material with consumers, but whiteware and electronics companies continue to use it for very good reason. The alternatives have failed to adequately protect the product during transit. Many of these large companies are also working with their local EPS Associations to ensure the packaging material can be collected and reused or recycled.

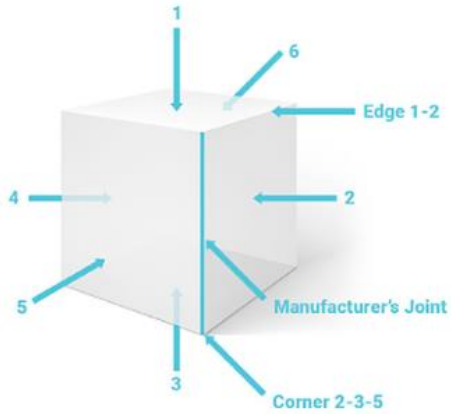
Electronic goods of all types are required to pass stringent transportation testing before they are able to be sold (e.g. ISTA 3A[28], ASTM D5276-98[29]. This is to prove that they are able to withstand the rigours of the distribution system. Fully packaged products must pass a series of tests (below), followed by inspection and functional testing to ensure they are safe for use by the customer. EPS is very difficult to beat in this application due to its high impact properties and mouldability. Many heavier weight products such as whiteware, air-conditioning units and other electronics goods cannot pass this testing without EPS protective packaging.

A typical test process involves:

- Preconditioning of packaged product followed by exposure to variable temperature and humidity. This provides thermal stress on packaging and product materials and creates condensation on the packaging which can impact the physical performance during transit.

- Drop Testing: Each item is dropped 10-17 times from a height (related to weight). The image below identifies the carton features for the testing. The item is dropped onto each face (1 – 6), the bottom corner of the manufacturers joint (2-3-5) and then the three edges leading away from this corner. In some cases, this testing is carried out to simulate real-world situations. For example, a refrigerator being shipped in a truck across the USA in winter might be chilled to -20°C prior to the drop test and dropped from a height equivalent to the truck bed[30].

[25] U.S. Department of Health and Human Services Centers for Disease Control and Prevention, Vaccine Storage and Handling Toolkit https://www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf
[26] Information provided by USA contacts at EPS-IA
[27] NZ Trade Dashboard: https://statisticsnz.shinyapps.io/trade_dashboard/
[28] ISTA-2A Overview, https://ista.org/docs/3Aoverview.pdf
[29] ASTM D5276-98, https://www.astm.org/DATABASE.CART/HISTORICAL/D5276-98.htm
[30] Based off transport testing experience gained while an engineer for a NZ whiteware manufacturer



- Vibration testing is carried out which provides randomised variation similar to that experienced during transport. This is often done on multiple faces of the carton (e.g. 1, 3 and 2 above) unless the product has a specified shipping orientation.
- Compression testing is carried out which applies a weight (based on the amount of product that can be loaded onto pallets in a container) for a set length of time.
- Following the transport testing products are typically inspected visually for damage and breakages, and then tested for electrical safety and general functional performance.

8. Costs & Benefits of a Mandatory Phaseout of EPS

Q9: What would be the likely costs or benefits of phasing out all PVC and polystyrene packaging (hard polystyrene and EPS) by 2025?

Q13: Have we identified the right costs and benefits of a mandatory phase-out of the targeted plastics? If not, why? Please provide evidence to support your answer.

Q14: How likely is it that phasing out the targeted plastics will have greater costs or benefits than those discussed here? Please provide details to explain your answer.

Costs have not been correctly identified and will be much greater than discussed in the consultation.

Costs would be high for manufacturers of EPS packaging, importers and exporters of seafood, pharmaceuticals, and heavier electronic equipment used across most sectors of the economy (e.g. medical, laboratory, manufacturing, consumer retail, telecommunications, construction and infrastructure). There are also potential significant impacts on the community through reduced food safety, increased product damage, or reduced product availability. Additional waste management and recycling costs would also be incurred as the alleged alternatives typically use multiple materials across multiple waste streams.

A mandatory phase-out cannot be achieved without undue costs to the businesses within multiple critical supply chains.

The costs to industry have been significantly underestimated for EPS packaging used for cold-chain and protection. This applies to all parts of the system from the EPS manufacturers, to their direct customers in NZ, to manufacturers of product imported into NZ.

Page 45 claims that *New Zealand's active plastics manufacturing sector will be affected by a phase-out of some hard-to-recycle plastics. However, the targeted plastics may be one of a number of products they manufacture. This policy will not affect other products like EPS insulation and construction items, and PVC piping.*

New Zealand has several EPS manufacturers specialising in cold-chain and protective packaging. A blanket ban on EPS would result in the closure of these businesses, and the loss of multiple jobs and contribution to the NZ economy. A company under threat from this proposal is one of the NZ plastics companies furthest ahead in the journey to a low-emissions circular economy. Hope Moulded Polystyrene[31] is a signatory to the NZ Plastics Packaging Declaration, operates under a zero-waste policy, are running on up to 85% solar energy, are certified members of Operation Clean Sweep[32] and work with the Nelson Community to recover and recycle post-consumer polystyrene. Government action that irreparably damaged the operations of such a forward-thinking company would send a very poor message to the rest of New Zealand's plastics manufacturers, and indeed the entire manufacturing sector. The loss of jobs also goes against the Governments commitment to support regional economic development as it would have a significant negative impact on the Richmond community.

The claim that the policy will not affect other products like EPS insulation and PVC piping is simplistic and somewhat naïve. Any policy banning an entire category of material from one application is going to raise questions for the public as to why those materials are still being used elsewhere. Labelling PVC, EPS and polystyrene as 'bad' in the packaging space will absolutely lead to reputational damage for products made from these materials and used in other sectors. There will be a variety of costs incurred from this including direct loss of sales for the companies involved, and potential job losses. There is also a potentially significant impact on New Zealand's plans to create greener buildings. EPS is an essential material providing insultation for low cost and resource use in comparison to alternatives. It is also used extensively used in flooring systems to reduce the amount of steel and concrete used (lower carbon footprint).

For those in the Seafood sector there are multiple impacts which could be extremely costly in the scenario where a blanket ban is carried out. The impacts relate both to the local supply chains and exports of seafood. New Zealand has very few dry-pack lines. The majority of alternatives proposed for EPS packaging are cardboard based. The known issues arising from banning EPS are:

- Damp/wet cartons lose their structural integrity. Those at the bottom of a pallet load of product collapse and result in significant loss.
- Damp/wet cartons have reduced thermal performance. Given these alternatives are already not matching EPS in performance, this further reduces their capability.
- Poor thermal performance of packaging threatens the organisations ability to meet MPI requirements for food safety. It also threatens their ability to successfully export product.
- Poor thermal performance increases the risk of foodborne illness and reputational damage.
- It is not a simple proposition to change from a wet-pack line to a dry-pack line. Generally, this is only done in a green-fields situation where the company is setting up a completely new operation. Many years of planning and capex raising are required before this can be done. Those companies I have spoken to have indicated either no plans to move to dry-pack lines, or that any plans are long term (5-10 years) and they are not in a position to change prior to that. Particularly with the ongoing challenges Covid-19 is presenting, and long consenting processes (new builds generally required).

Importers and exporters of electronics goods and machinery utilising EPS for protection will face the following challenges (retailers and brands included for exports):

- Continued costs of investigating alternatives to EPS (note this is already occurring, unsuccessfully in a large number of cases).

[31] https://www.hmp.co.nz/sustainability
[32] https://www.plastics.org.nz/environment/marine-litter/operation-clean-sweep

- Increased product damage is likely resulting in higher costs to repair or replace products. Reputational damage will also be incurred.
- For those who chose to still ship product to NZ: Increases in packaging costs and packed product size. The alternatives to EPS are more expensive. As they are also less impact resistant more material is required to match EPS. This increase then pushes the box size up. Increased box size means fewer products are able to be shipped in the same space. Not only does this increase the freight cost per unit but it also increases the carbon footprint of the product as more trips are required to ship the same amount of product.
- As the margins are often extremely tight on consumer products the issues discussed above, particularly in relation to less efficient supply chains, will mean that some companies chose not to ship their products to NZ. Ours is a very tiny market in the global system. It is very likely that NZ would be presented with the option of 'take the packaging or lose access to the product' by some companies. They are not going to spend large amounts of capex and R&D to change packaging formats and production lines to suit a very small portion of their market.

The potential costs/risks to the community from a blanket ban of EPS that removes it from cold-chain and protective packaging:

- Increased food-borne illness due to failures to maintain safe temperatures during shipping (e.g. Hello Fresh food poisoning[33]).
- Increased product damage of larger, and more expensive, consumer electronics such as whiteware. Inconvenience of needing to return to store and get replacement.
- Reduced options for purchasing of larger consumer electronics. Some brands would be unable to replace EPS cost-effectively and would chose-not to ship product to NZ.

9. A Discussion on the Alternatives to EPS

Q10: Do you believe there are practical alternatives to replace hard-to-recycle packaging (EPS)? If not, why?

No – while many alternatives have very clever marketing 'spin' and claim equivalence with EPS, real-world testing has shown that the alternatives are not viable. The alternatives also generally cost significantly more in terms of unit price, labour, and freight (weight).

The information below has been gathered from our Members and their customers. For commercial reasons this is aggregated and not linked to a specific company unless it was provided directly to Plastics NZ. For company specific details and evidence please reference submissions from the EPS packaging manufacturers, seafood producers, pharmaceutical companies and those dealing with electronic goods such as Fisher & Paykel Appliances and the Japanese Electrical Manufacturers Association.

9.1. Cardboard with Wool Insulation

Table 5 of the Consultation suggests a cardboard carton with wool insulation as a replacement for EPS in cold chain supply lines. There are a number of issues with this which mean this packaging is not viable for all cold-chain supply lines. These are discussed below. We note that this is currently the best alternative on the market in terms of thermal performance, so we cover this option in

[33] https://www.nzherald.co.nz/nz/hello-fresh-food-poisoning-20-more-people-report-symptoms-after-eating-spoiled-fish/MJUJVDPF6FWXI5ZBUV7EZN2B7A/

detail. Less information is provided on other cold-chain alternatives as they do not match the performance of this wool-based option.

- The packaging is based around a cardboard carton.
    - Cardboard absorbs moisture from exposure to wet areas of factory, ice-melt from within, saltwater release from live animals, and condensation on exposure to humid environments (experienced during transit).
    - Cardboard loses its structural integrity when damp. As the majority of shipments involve stacking of packed product onto pallets, multiple layers high, this results in collapse of cartons on the bottom layer and loss of product. One seafood producer[34] noted that a cardboard option could withstand the loading with *careful* stacking. However as soon as the product was restacked by freight workers at airports and distribution centres (up to 5 times in transit to Shanghai) problems occurred. The risk of box deformation, and therefore product damage and loss, was too high for them to risk. Added to this is potential liquid spillage in aircraft which is extremely undesirable.
    - The product that NZ is shipping in EPS tends to be high quality, premium produce, vaccines and pharmaceuticals, biologics, and scientific samples. These all have considerable value and packaging failure would cause significant loss. In some cases, such as with vaccines, pharmaceuticals, biologics and scientific samples, the community would also be impacted.
    - Seafood product shipped to Japan goes through a process where a hole is punched in the bottom of the packaging to let any liquid or ice melt out. The product is then re-iced. Cardboard is not accepted for this process as the liquid would destabilise the cardboard and the structural integrity would be lost, rendering it useless as a carrier.
- The insulative properties of the wool insulation do not match EPS
    - While the wool insulation is a good option for some products, particularly where the product is always in a chilled environment, it does not work for all applications. Real-world testing shows rapid temperature rise of product when exposed to higher ambient temperatures. It also does not work very well when used in non-chilled delivery channels.
    - Many seafood companies in NZ, particularly those in the regions, use overnight courier to get their product to customers as quickly as possible to maintain quality and freshness. For overnight couriers non-chilled service is the only option available. Any chilled freight services, particularly between the lower South Island and the North Island, offer at best a two-day delivery service. Costs of this are also prohibitive. EPS is the only packaging option offering the level of insulation required to maintain product temperatures within safe limits through the non-chilled distribution.
    - Products moving through airports and multiple distribution centres, particularly for exports, tend to have periods where they are exposed to higher ambient temperatures. Most airports domestically and internationally do not have chillers. It is critical for product safety across all cold chain supply lines (seafood, pharmaceuticals and other products) that the product temperature is maintained during these transition points. One exporter of premium seafood described

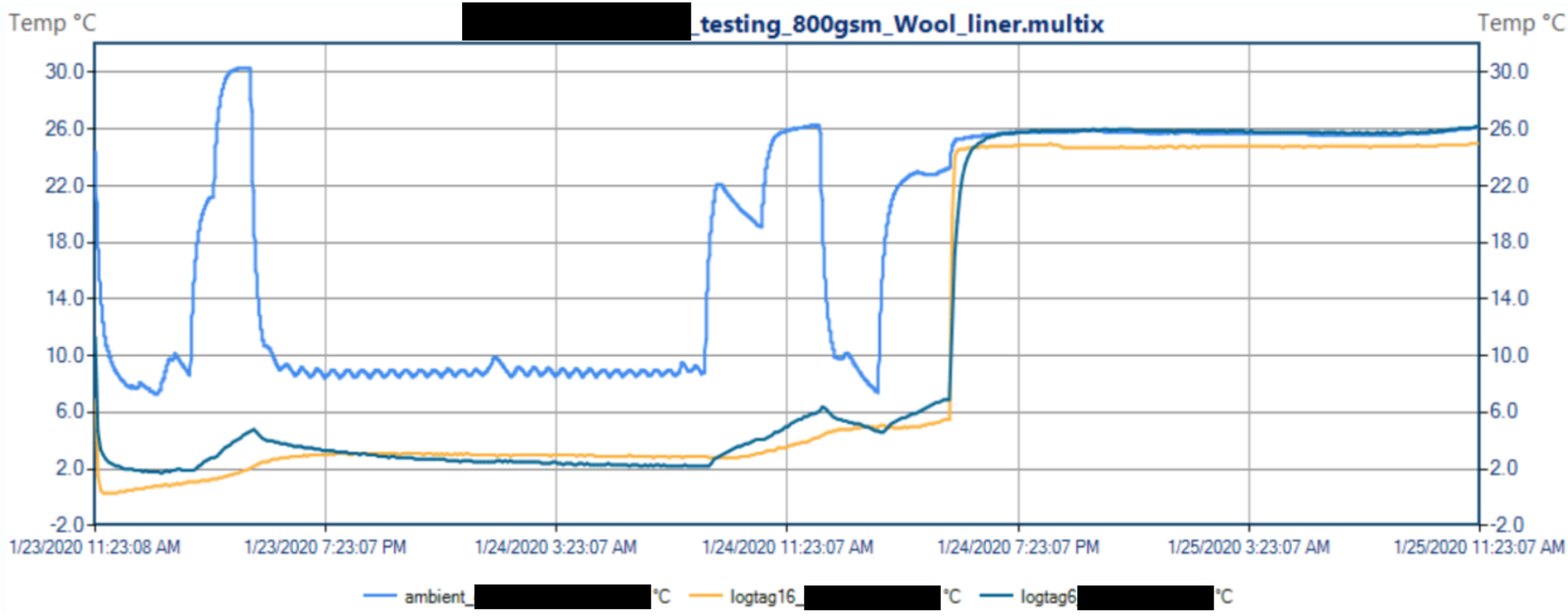
[34] Contact details for Seafood Producer provided on request.

personally witnessing their products sitting on the tarmac in the hot sun for 3-4 hours. Without EPS the product would have been well above temperature.

- A biotechnology company, who is conscious of the environmental impacts of the materials they chose, has trialled multiple packaging options. They have very strict validation requirements to ensure their biologics, vaccines and pharmaceutical products reach customers safely and unspoilt. They have found that EPS provides superior thermal and physical protection to alternatives as well as being reliable and cost-effective.
- The graph below shows testing results for bivalve molluscan shellfish in a cardboard carton with wool insulation. The trialling company was not satisfied with the rapid temperature increase of the seafood to more than their 4°C limit during the testing. Overall, the product spent more than 7 hours above the limit in the first 30 hours of testing. This is the maximum temperature for their products during shipping for food safety reasons.
  - The first test of the insultation occurs when the ambient temperature is increased to 30°C for a short period. The product temperature increased rapidly to 5°C over 2 hours. It then took over 5 hours for the product to drop back to 2°C.
  - The second test occurred with a lift of ambient temperature to between 19°C and 26°C over a 4 hour period. The product temperature exceeded the 4°C limit within 2 hours and reached higher than 6°C within 4 hours.

- Recyclability and cost:
  - The wool insulated cardboard packaging utilises multiple packaging materials; heavy gauge cardboard carton, wool pad, plastic bag wrapping wool, and often an additional bag separating the product and the wrapped insulation.
  - Additional labour and time is required to assemble and line the packaging.
  - Additional gel pads are required to maintain product temperature (note this does not work for all situations).
  - Costs for the packaging is higher than EPS both in terms of packaging unit price, the additional labour required, and additional freight costs due to higher weight.
  - While clean cardboard is readily recyclable, damp cardboard would likely be rejected – particularly if contaminated with liquid from seafood product. While theoretically compostable, as is the wool, the infrastructure and collection systems for composting are lacking on a global basis. Soft-plastics, such as the wool wrapping and liner, are also problematic globally. The most likely end-destination for this packaging is landfill or incineration in the majority of markets around the world. As with plastics the focus needs to be on actual recyclability or compostability in practice and at scale[35]

[35] Ellen MacArthur Foundation *New Plastics Economy Global Commitment* https://www.ellenmacarthurfoundation.org/assets/downloads/Global-Commitment-Document-to-download-on-website-2.pdf



Note: identifying information has been redacted due to commercial sensitivity. Details may be provided to government officials on request.
Packaging format tested – 72cm x 29.5cm x 23cm (49L). 800gsm wool liner. 3x900g frozen gel bricks on top of payload. Sensors on top and side of payload.

9.2. Expanded PLA (EPLA)

One alternative proposed for EPS is Expanded Polylactic Acid (EPLA or Zealafoam). At present this is not commercialised, but trials have been carried out in New Zealand for this packaging. It shows good promise in terms of thermal properties and strength. However, there are some issues with viewing EPLA as an alternative to EPS. In general, it offers minimal advantage and additional challenges:

- EPLA is a drop-in solution for EPS in that it has a very similar structure of small beads joined together to form the shape. At present this is not commercially viable for packaging applications as the cycle times to manufacture are extremely long (impractical). The material is also very expensive.
- EPLA is commercially compostable. If it is leaked from waste management systems or littered it will behave very similar to EPS in that it will fragment into small particles. As the conditions required to biodegrade the material are not present in the natural environment the material will not break down and will pose the same risks to the ecosystem as EPS.
- Commercial composting infrastructure that will handle PLA is minimal within NZ and globally. Plastics composting infrastructure is generally several steps behind plastics recycling. To successfully implement this packaging product stewardship would be required to create a collection system and facilitate actual composting of the recovered materials.
- To the public EPLA looks very similar to EPS. A change of material does not change the root causes of leakage and litter, therefore to the public the problem will not go away.
- PLA has a glass transition temperature of ~60°C[36]. This is the point where it starts to soften. Non-refrigerated containers are typically used for shipment of electronic goods. In areas of the world where ambient temperatures are higher, particularly if sun is also a factor, these steel containers will frequently reach temperatures above 60°C. This presents a threat to the product if the impact properties of the packaging are lost due to softening.
- Trials by an exporter of live rock lobsters found that the material provided good thermal insulation and strength but that it leaked water making it unsuitable for transport by air. The company considered lining the bins with an additional layer of plastic but given the unknown (and presumed high) cost of the bins they have not pursued this labour-intensive workaround.

9.3. Other Cold-Chain Alternatives

Chilltainer:

- The Chilltainer is a heavy-weight cardboard carton with a metallised polyester layer added to increase thermal properties[37]. Investigations by Plastics NZ and trails by producers have highlighted the following:
    - The material is not recyclable in NZ despite claims that it is 95-97% recyclable. The polyester layer prevents onshore recycling. There are some markets offshore if the material can be collected in bulk. Recyclers will not take contaminated material however so only post-industrial waste is accepted.

[36] Hitachi High-Tech Science Corporation, *Thermal Analysis of Polylactic Acid – Crystallinity and heat resistance,* https://www.hitachi-hightech.com/file/global/pdf/products/science/appli/ana/thermal/application_TA_081e.pdf

[37] https://chilltainers.com/nz/

- Thermal properties of the Chilltainer are not much better than a similar weight cardboard carton (trial feedback) and do not meet requirements of cold chain.
- Issues with cardboard discussed in Section 9.1 are applicable.

Cool Pouch:

- The Cool Pouch is made from recycled PET and appears to be a plastic pouch filled with PET fibre. While the company claims this is fully recyclable it is not currently recyclable in NZ.
- There is no data on the thermal performance of this packaging option but recent histamine poisoning issues with Hello Fresh fish, who use Cool Pouch, indicates there may be some issues.

Coolseal:

- Coolseal is a polypropylene (PP, #5) packaging option. There is not a lot of data available on this packaging. It is likely recyclable in NZ as it is polypropylene. However, Fish Industry Services, the NZ supplier, states on their website[38] that it can't be used in every application as shown below. EPS is required any time extra insulation is needed.

> **Can Coolseal boxes replace EPS for every job?**
>
> The simple answer is no. At any time when the extra insulation of EPS is needed it should be used. Individual boxes of product being sent by courier is one example of conditions requiring EPS.

9.4. Moulded Cardboard

Table 5 of the Consultation suggests moulded cardboard as a replacement for EPS in protective packaging applications. While this has been successfully used on small-scale products and electronic goods it is not robust enough to withstand the high impact requirements of packaging for heavy electronic goods such as whiteware and refrigerators.

Due to consumer pressures manufacturers of heavy electronic goods, such as Whiteware, large consumer electronics and machinery, have trialled numerous alternatives including moulded cardboard. The alternatives have failed during the transport testing. Because of this both local and international manufacturers of these goods, and their distributors, are very concerned about the proposal to ban all EPS packaging. They do not see viable alternatives available. For more information please see the submission being sent in by Fisher & Paykel Appliances, and those from the representatives of various manufacturers and distributors. We understand submissions will be received from at least the following representative bodies:

- Consumer Electronics Association of New Zealand
- Japan Machinery Center for Trade and Investment (JMCTI)
- Japan Electrical Manufacturers' Association (JEMA)

9.5. Other Alternatives for Protective Packaging

Other foams (PE, PP, Cellulose etc), mushroom packaging,

Other Foams:

- Other foams are available on the market made from PE and PP. The manufacturing method for these produces wire-cut layers that are then adhered together to provide the structure required. While the impact properties of these foams can be acceptable, they are not recyclable in NZ due to the unknown nature of the adhesives used to join the layers. They are also expensive according to the brands who have tested the materials.

[38] https://www.fishindserv.co.nz/coolseal-vs-eps.htm

- Cellulose foams exist on the market. To date these do not perform well in impact tests as the fibres do not have the elasticity of plastic. Once compressed or dented they do not withstand secondary impacts well. While these may be compostable the same issues exist as for other compostable packaging – there is no collection or composting infrastructure readily available to allow composting at scale.

Mycelium (Mushroom) Packaging

- A recently developed packaging alternative being discussed in NZ is mycelium (mushroom) packaging which is grown rather than manufactured. Mycelium is a network of fungal threads. They are grown on a substrate (normally a waste biomass such as corn stalks, wood chips etc.) forming a tightly knit structure. A typical growing time is 7 days[39].
- While still quite new and unproven in terms of consistent material properties this material generates a lot of excitement in the media. It is made from natural materials and is fully compostable. While it has good potential for certain applications there are a number of concerns:
    - The long growing time makes this packaging unattractive for those manufacturing and shipping large quantities of products. Particularly along-side an unknown, but presumed expensive, price-point.
    - The thermal properties need to improve ~30% to match EPS[40].
    - The compressive and impact strength of the material is inconsistent and not high enough to meet transit requirements for heavy products.
    - Producers have questions around biosecurity regulations for imports/exports.
    - Mycelium packaging is apparently attractive to rodents.

Honeycomb Board

- Fully recyclable honeycomb paper composite panel is an option being trialled. This works very successfully on smaller electronics.
- Testing on larger electronics has found that once the honeycomb structure has yielded, the structural integrity is lost leading to product damage throughout the rest of the transit period.

9.6. Impacts of Alternatives on Producers

- Increased packaging costs – both unit prices and additional labour
- Increased transport costs as alternatives are heavier leading to higher freight charges.
- Increased transport costs due to having to utilise refrigerated shipping or specialised scientific shipping equipment (pharmaceuticals, biologics and samples).
- Increased animal welfare concerns for live animal shipments (e.g. rock lobsters and shellfish)
- Loss of access to Japanese market resulting in significant revenue loss
- Reduced reliability of packaging structural integrity leading to product damage or loss.
- Failure of packaging to maintain required temperatures through complex delivery chains, leading to product loss and/or safety issues.
- Reputational damage from increased product loss.

[39] https://www.paradisepackaging.co/

[40] Girometta, C.; Picco, A.M.; Baiguera, R.M.; Dondi, D.; Babbini, S.; Cartabia, M.; Pellegrini, M.; Savino, E. Physico-Mechanical and Thermodynamic Properties of Mycelium-Based Biocomposites: A Review. *Sustainability* **2019**, *11*, 281.file:///C:/Users/Rachel/Downloads/sustainability-11-00281.pdf

- Requirement to potentially change entire product handling and processing system to dry-pack line resulting in hundreds of thousands of dollars in capital expenditure (per company) that companies cannot afford.

10. A Discussion on Reuse

Q15: What would help to make it easier for you and your family, or your business/organisation to move away from hard-to-recycle plastic packaging and use higher value materials or reusable/refillable alternatives?

Government support for investigation into reuse systems for the local market.

Within the local supply chain there is potential to create systems where reusable packaging can be utilised. EPS packaging is already reusable, and in some cases is already being utilised in this manner (particularly pharmaceutical, catering, logistics). Government support to investigate and trial the implementation of reuse systems within the cold-chain supply lines would be useful to accelerate the adoption of reuse systems.

International shipping (exports and imports) is a completely different proposition. When considering seafood exports for example, New Zealand exports ten times more seafood (by value) than we import. There is only a remote possibility of collecting reusable packaging from the many countries we ship to and pulling it back to New Zealand. The reciprocal supply chain does not exist meaning that cost efficiencies gained from back-filling are not possible.

11. Appendix 1: Assessment of Options

The following notes apply to the assessment for Table 6.1.

Effectiveness:

- Redefined to ask *Will the option advance the elimination or reduction of EPS ending up in landfill or littered?*
- The Packaging Accord was a voluntary agreement. All targets set out in the Accord were met within the target timeframes. This shows that a voluntary agreement can be at least 'somewhat' effective.
- Reduction targets, backed up with strong government leadership and associated education and action, would be at least 'somewhat' effective as it would provide industry with clear information as to the direction of the NZ system.
- A mandatory agreement with set targets (Option 9 as proposed in Section 5.0) would therefore be a 'yes' effective as the combination would be highly effective.
- Labelling would not be effective for EPS cold chain and protective packaging so this is analysed as 'no' effectiveness. Labelling provides information but does not drive behaviour change.
- Formalised product stewardship, which required the retailers and producers to be involved in ensuring takeback and recycling of necessary EPS packaging, would be effective.
- Option 'No Change' would have 'minimal' to 'somewhat' effectiveness for EPS packaging. As discussed in Section 3.1 there was already work underway to increase collection and recycling rates and the industry has actively been investigating product stewardship options. However, to be successful the big-box retailers (primary source of packaging EPS) would need to engage.

Costs:

- Options 1, 2, 5 and 9 (mandatory agreement) are viewed by industry to have similar cost increases for the community, business and public funds. Overall, these are all analysed as 'somewhat' in regard to implementation without undue costs, given that costs will be incurred by both business and the end-user.
- Mandatory phase-out of EPS in the cold-chain supply line and for protective packaging has significant impacts on business (See Section 8.0). This is assessed as 'No' it cannot be implemented without undue costs.
- Recycled content cost is viewed as having 'minimal' costs for this type of EPS packaging as this is already being carried out by manufacturers. Compacting of materials is not difficult and does not require a large amount of capital investment. Introducing recyclate into other products requires more capital and R&D but not an undue amount.
- For 'No change' option there are no undue costs. Businesses can change as their capex and budgets allow. Increases in product costs due to changes can be built in over time, and gradually meaning no undue costs on the consumer or business. While this means an assessment of 'yes' could be made a 'somewhat' is applied due to uncertainty of engagement of retailers.

Alignment with strategic direction

- The relationships across the plastics, packaging, resource recovery and government sectors in New Zealand are very collaborative and have a common goal of achieving circularity for plastics. Any agreement, reduction targets or other scheme would be instigated with this goal in mind. At minimum therefore any agreement, reduction target set, or other scheme would align 'somewhat' with the strategic direction.

Achievable without new legislation or amending legislation?

- The designation of 'somewhat' achievable for voluntary agreement, reduction targets seems strange. These are achievable under current legislation. These are therefore changed to 'yes'. New option 9 (mandatory agreement) set as 'no' as unsure about this.

- The implementation of a mandatory phase-out is dropped to 'somewhat'. A phase-out would require modification to the *National Standards for Vaccine Storage and Transportation for Immunisation Providers 2017 (2nd edition)* as published by the Ministry of Health[41].

[41] https://www.health.govt.nz/system/files/documents/publications/national-standards-for-vaccine-storage-and-transportation-for-immunisation-providers-sep19.pdf