Reducing Food Loss & Waste in the Frozen Potato Supply Chain

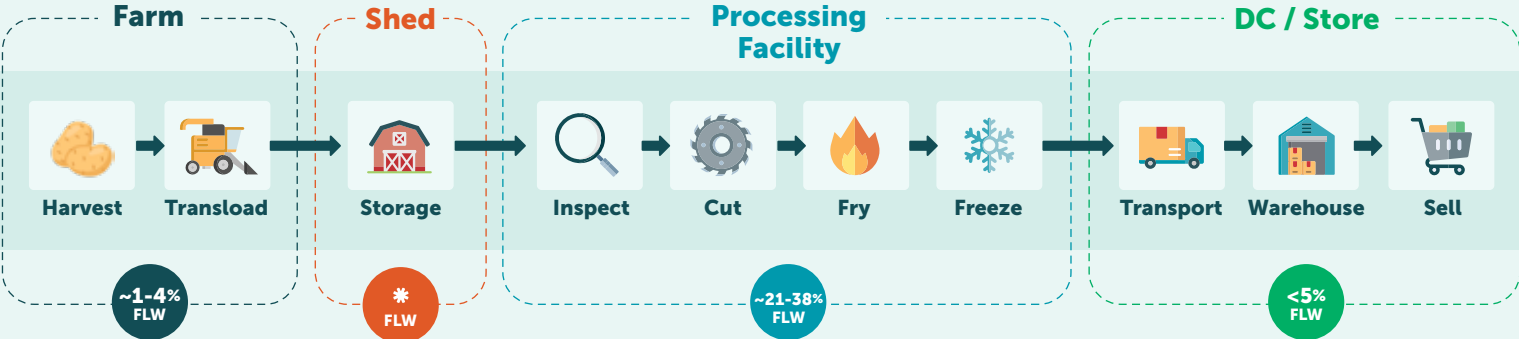Using a whole-chain approach from farm to retail stores

PACIFIC COAST
Food Waste Commitment

Winter 2024

Executive Summary

The Pacific Coast Food Waste Commitment (PCFWC) commissioned a study of food loss and waste (FLW) in the frozen potato supply chain to identify hotspots and opportunities to keep more edible products in the human food chain. Several companies participated in the research to represent the supply chain from farms through processing, distribution, and retail.

Frozen Potato Supply Chain with Food Loss and Waste Rates

Farm		Shed	Processing Facility				DC / Store		
Harvest	Transload	Storage	Inspect	Cut	Fry	Freeze	Transport	Warehouse	Sell

~1-4% FLW   * FLW   ~21-38% FLW   <5% FLW

% FLW is the percentage of food loss and waste that occurs out of the total food cultivated or received at each point in the supply chain. In this report, FLW includes any potatoes not delivered for human consumption.

* = unable to obtain data for Shed stage.

Identified Solutions

At the Farm and Processing Facility

- **Enhance data collection** on the type and volume of FLW generated on farm and at each step in production to inform relevant operational adjustments, identify upcycling possibilities, and assess potential economic return.

- **Gather production employees' insights** to generate ideas around why FLW is generated and how to increase potato utilization.

- **Connect with excess inventory platforms** to tap into new channels to sell surplus or out-of-specification finished goods (products that don't meet standards set by the customer but may be fully edible).

Across the Chain

- **Adjust existing product lines** to increase potato utilization.

- **Create new product lines** to revalorize out-of-spec food through upcycling.

At Retail Stores

- **Fortify cold chain infrastructure** to minimize waste resulting from freezer failures.

Introduction

Reducing food loss and waste (FLW) requires coordination among stakeholders across the entire supply chain. Using a whole-chain approach to study FLW provides comprehensive insight into the flow of material, relative waste hotspots at each node, and opportunities to increase the amount of potato utilized for human consumption.

For this project, the PCFWC gathered stakeholders from across the frozen potato supply chain to study loss and waste from harvesting through retail sales. The products studied were mainly frozen french fries. The team was composed of staff from the PCFWC, supply chain experts, growers, processing facilities, and retailers.

Over seven months, the team interviewed subject matter experts, collected data from enterprise software systems, and visited farms, storage facilities, processing facilities, distribution centers, and stores. On-farm post-harvest measurements were performed twice during the 2023 season.

Within the processing facilities studied, most solid organic materials not converted to finished goods go to animal feed. The U.S. Environmental Protection Agency's Wasted Food Scale does not consider that material FLW, but it does put human consumption above animal consumption. One aim of this study is to find logistically feasible and economically compelling ways to retain more food for human consumption.

Scope of the Study

Source and Timeframe

On-site measurements, plus production, warehouse, and store data from 2021-2023

Material and Lifecycle Stage

Whole potatoes from harvest to frozen products at retail grocery stores

Waste Destination

Left in field, sent to animal feed, compost, anaerobic digestion, or landfill (not delivered for human consumption)

Geography

Farms and Retailers in the Pacific Coast region

Why study potatoes?

Demand for potatoes is soaring, and almost one million acres of potatoes are planted in the United States each year. More than a third of the potatoes grown in the U.S. end up in the frozen market sold through grocery stores or restaurants. Effective coordination across the potato supply chain and targeted interventions could have a huge impact on food loss and waste volume.

Sources

https://www.nass.usda.gov/Surveys/Guide_to_
NASS_Surveys/Chemical_Use/2022_Potatoes_
Wheat/ChemHighlights-Potato%20FINAL.pdf

https://www.nytimes.com/interactive/2023/09/03/
climate/minnesota-drought-potatoes.html

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What Drives Potato Loss & Waste?

Farm and Shed

Potatoes are harvested between July and October using row harvester machines, which require minimal labor. Processors typically contract with growers to secure their supply of fresh potatoes, often purchasing entire crops. Since frozen potato production runs year-round, most of the volume is stored in large sheds to be used in the months after harvest. Sheds are controlled for temperature, humidity, light, and ventilation and can store thousands of tons each.

Losses and Why They Occur

FLW at the farm is relatively low at approximately 1-4% of harvested potatoes and is often comprised of small potatoes (<2" diameter) that drop through harvesting chains or off transloading conveyer belts. Nearly all unharvested potatoes are plowed under, which does benefit the soil. In storage, the amount of FLW is unknown but presumed to be small and driven by spoilage. FLW from storage sheds is typically used for flakes and sometimes sent to cattle feed.

Emptying potatoes from long-term storage shed

Processing Facility

Potatoes are transferred to a processing facility where they are sized, washed, peeled, inspected, cut, battered, fried, frozen, bagged, and palletized. Finished product is stored in distribution centers, sometimes run by third-parties, for shipment to retailers and foodservice distributors/outlets.

Losses and Why They Occur

The largest volume of FLW in this supply chain occurs at the processing facility. For this study, this represents between 21-38% of the raw volume entering the facility, a range that comes from distinct measurement methodologies. FLW is due to product not meeting specifications (e.g., dark spots), discarded peels, batches that fail quality control checks, strict food safety measures, and operational and equipment inefficiencies. The largest category of waste is "wet," which is generated between the process stages of receiving potatoes through cooking them. "Frozen" waste refers to product discarded after freezing, including packaged items. Nearly 95% of waste from the facility is sold as cattle feed.

Food loss and waste during processing is comprised of:

62% Wet Waste
Generated prior to freezing during receiving, sorting, peeling, cutting, frying, and inspection

- Short pieces
- Defects
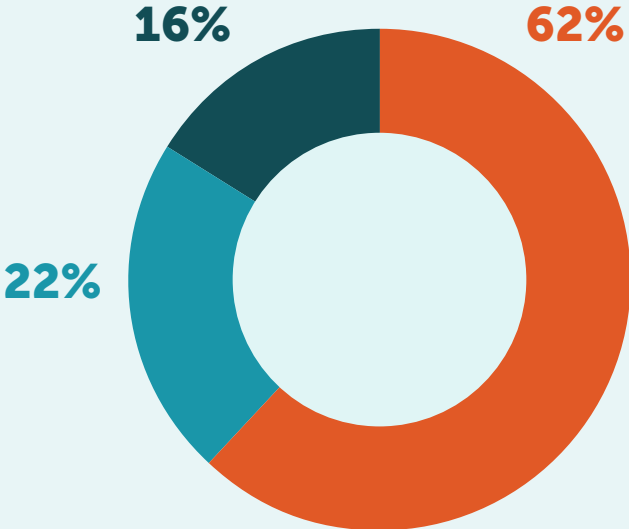- Potato peels
- Out-of-spec product

22% Frozen Waste
Generated after product is frozen and through packaging

- Out-of-spec frozen product
- Wrong packaging

16% Waste Slurry
Generated at all stages of processing

- Oil byproducts
- Used oil
- Solid residue

16% **62%** **22%**

Distribution Center and Store

There is typically minimal waste of frozen potatoes at the distribution center and grocery store level. When stores have outdated or incomplete freezer infrastructure (e.g., lack of backup generators), waste occurs due to periodic cold-chain failures. In the study, retailers without in-store backup generators experienced ~5% loss, while retailers with more reliable cold-chain infrastructure experienced <1% loss at the store.

Solutions

Many potential solutions were examined to reduce FLW in the frozen potato supply chain. Those presented meaningfully address a major hotspot and build upon proven success stories. Some solutions require collaboration between multiple stages of the supply chain, others can be implemented unilaterally by one business.

Developing Solutions at Farms and Processors

1 Enhance Data Collection

While existing data collection at the processing facility level captures overall FLW, it lacks specificity in identifying where or why the product was not utilized. Detailed facility-level data may exist but can be challenging to extract, consolidate, and report on.

A more granular understanding of the causes, volume, and consistency of FLW will inform how processors can make improvements directly (e.g., operational fixes) and where they could work with external organizations such as upcyclers. This data can also help processors work with producers to reduce the amount of out-of-spec product, for example through providing feedback on different varieties and other agronomy support.

To gain initial insight, a processor could run a pilot program by selecting a representative timeframe at one facility and weighing the volume of material being discarded at each process point. Material that is repurposed internally would be excluded (e.g., too-short french fries turned into hashbrowns). The results would indicate areas of consistent FLW that could be prevented, including potatoes that might still be saleable.

At the farm level, more sampling could be done to understand the amount of potatoes left in the field and how much could successfully be collected. While the percentage of yield left unharvested on farm is relatively low, there may nonetheless be a significant quantity of potatoes which could be utilized depending on the number of acres under production. For example, WWF's report Maximizing Farm Resources and Edible Food Rescue (2018) estimated that 103.8 million pounds of potatoes per season were left in the field across just over 92,000 acres in 2017.

2 Engage with Employees

Front-line workers possess valuable insights into the root causes of waste. Engaging with them can help identify the frequency, causes, and possible prevention measures for waste, as was shown in an employee engagement pilot conducted by Bob's Red Mill and the PCFWC in 2022. An incentive program can foster idea generation and collaboration. Participation from areas like product development, sales, strategy, food safety, and quality assurance would enhance the brainstorming process.

3 Connect with Excess Inventory Platforms

Processors can work with external organizations to recoup value from excess finished goods inventory that may not satisfy requirements for existing retailers. Companies like Spoiler Alert have created digitized platforms that generate revenue for the user by selling the excess inventory to secondary outlets. For a small fee, they help broker excess product and streamline donations.

Whole Chain and Retail Solutions

Change Specifications or Revise Product Offerings

Food loss and waste within processing facilities represents opportunities for new product lines or upcycling. These efforts require a whole-chain approach where processors and their customers collaborate on changes.

One approach is to adjust existing product specifications to increase potato utilization. For example, retailers and manufacturers should enhance promotion of peel-on product to eliminate the need for removing potato peels, a significant source of potato waste within the facility. The value of peel-on products could be promoted to consumers, emphasizing nutritional, taste, and environmental benefits.

Processors and retailers may also be able to develop new product lines that integrate materials currently treated as FLW, capitalizing on the popularity of upcycling and imperfect foods, which are growing beyond specialty stores and into mainstream retail.

Processors could also explore partnerships with customers beyond traditional grocery retailers and fast-food corporations, such as Misfits Market, Spudsy, and Matriark Foods. Several such businesses are building a model around selling upcycled food products derived from potatoes or other produce that would typically be discarded.

Fortify Cold Chain Infrastructure

FLW at retailers is generally low for frozen potatoes. When and where it does happen, the loss is usually attributed to an interruption in cold chains. Enhancing equipment at stores to have more backup generators could preserve the cold chain and save food during periodic power outages.

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Challenges

During the study, a few additional themes emerged that point to the challenges of developing solutions to FLW in the retail frozen potato supply chain.

Financial Considerations

Upfront cost of reducing FLW can often exceed the cost of wasting product, which could in the short-term make it financially unattractive to minimize waste.

Additionally, if the fully loaded cost of the unsold potatoes is not reflected in companies' accounting, the true financial impact of the waste is not visible. This also hinders making FLW reduction a priority for action.

Legacy Infrastructure

Older processing equipment tends to create more FLW. Comprehensive, detailed FLW data would enable companies to justify the cost of updating legacy facilities.

Consumer Preferences

Consumer preferences for products with no peel or no blemishes, for example, dictate product specifications. Retailers are reluctant to adjust products, but they could have an impact on reshaping consumers' desires and reducing waste.

Next Steps

This study has identified the key hotspots in a frozen potato supply chain on the Pacific Coast and detailed the reasons for FLW from harvest to distribution. The solutions proposed require more investigation, and an agreed upon next step is to get more granular waste data at the processing stage so as to scope out which edible byproducts or out-of-spec items would best be targeted for upcycling. Retailers will be engaged in establishing new SKUs for these upcycled frozen potato products. The learnings from this pilot can be applied to other supply chains and products, accelerating progress toward the Pacific Coast's food waste reduction target.

Acknowledgments

The PCFWC would like to thank the participating companies for their collaboration in developing this case study. It serves as an example of the important whole-chain collaboration required to develop best practices and accelerate progress on food waste prevention. The group would also like to thank WRAP, whose whole chain methodology inspired the project, and the consultants who authored the study: LIDD, Measure to Improve, and KOR Consulting.

About the Pacific Coast Food Waste Commitment

The Pacific Coast Food Waste Commitment (PCFWC) arose out of the Pacific Coast Collaborative in 2016 and is an innovative public-private partnership made up of West Coast jurisdictions, U.S. food industry leaders, and nonprofit resource partners that together seek to eliminate food waste in the region by 50% by 2030. Learn more about the initiative and its members at pacificcoastcollaborative.org/food-waste.

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