**Title:** Proposed protocol and considerations for baseline monitoring of key quality data related to frozen foods within the cold supply chain
**Date:** February 27, 2025
**Version:** 0.1
**Authors:** Nomad Foods – Quality considerations in the Frozen Food Supply Chain

# Quality measurement guidance

**Background**
As a guidance to enable initial trials this paper lays out potential quality measurement attributes that could be measured to demonstrate impact on the quality of the products used in such trials.

Food Safety is not a consideration of this paper, so no micro or viral testing is listed here. This is because this needs to be a separate set of clear data which establishes that this is not a material risk for this proposed change. The total body of evidence we submit to any authority must cover this aspect, be peer reviewed and have a preferably published scientific study in a recognized journal, of the impact of any change.

It should be made clear as part of the coalition guidance what the scope of warming is we wish to apply.
For instance – where safety factors are built in through specified temperatures, these must remain. An example of this is the temperature currently agreed to kill parasites in marine fishery products. This should be clarified as out of scope and will remain as is. This is currently set between -20$^{o}$C and -35$^{o}$C depending on time.
Similarly, extreme cold temperatures, such as that applied to Tuna to maintain quality, should also be classed as out of scope. This is currently set at temperatures as low as -60$^{o}$C. Again, this is not in the scope of this proposal.

As quality attributes vary hugely by product category this is, at this stage, a simple set of potential measurements which will enable us to start building a picture of possible sensitive areas that need to be considered as part of the goals of the coalition.

There needs to be general agreement that this proposal is only focused on general foods which are normally stored, produced and sold at -18C$^{o}$ (0$^{o}$F)

The key test for raw materials, intermediate goods, and finished products, is the overall shelf life at each stage. Shelf-life attributes normally establish the acceptable quality norms within with both food safety and sensory or appearance parameters can be guaranteed. We need to demonstrate as part of the performance of a warmer supply chain that this will remain true. This paper only considers the latter of these requirements, that being the acceptable quality norms.

The guidance below assumes that this is the aligned position:

## General Guidance:

- We need to intrinsically satisfy ourselves that the following are not impacted by this proposed change:
    - Shelf-life of the raw materials, intermediates or finished goods.
    - Claims are not impacted through undue loss.
    - There is no change to chemical, sensorial or physical appearance characteristics.
    - Cooking or usage instructions do not have to be modified to any great degree.

    - Recipes do not require modification to ensure stability.

- It is not necessary to test every product in the freezer cabinets, efforts should be taken to identify high risk and standard products from within each category to use as a demonstration of impact.
- We will need to measure quality attributes throughout the supply chain to ensure that B2B ingredients and items are not unduly impacted nor impact overall quality of the final consumer / retail items.

- We will also need to consider the final step of the journey to the consumers home – if we change our temperatures and this impacts their ability to get foods home at a quality companies expect, this will not get off the ground. This includes thinking about an abuse cycle.

    - Proposal: Abuse cycle could be pre-defined as a specified amount of time a product is held in ambient conditions or in a cooler bag (***nominally this provides a barrier to warmer temperatures for a short period of time through thermal insulation in the walls of the bag***) This is to replicate the amount of time a consumer takes to transfer the food from the supermarket/ store to home and back into their own freezers.
    - This abuse cycle should assume delays through consumers being delayed at tills, traffic jams, meeting friends and going to other stores as part of normal activities.
    - The period held at ambient could be nominally set at 2 hours, but we should align on this protocol of abuse to ensure consistency of results.

- High risk products are likely to be those which have specific characteristics which are either highly sensitive to temperature change (such as degradation of raw fish or ice-cream) or which have a high-cost value to both business and consumer.

- These should be tested in addition to those which are considered stable to give us as broad a picture as possible of the impacts of both fluctuations in the natural supply chain and the impact of changing the set point to a higher value.

- Measurements used within these testing parameters should be based on ISO norms or standard industry measurements to ensure compatibility of data.

- Operators within the industry who are brand owners should carry out assessments such as sensory evaluations as they are the best qualified to assess change against a given norm. For any such testing this would need to be built into any test plan as a partnership between the players in the supply chain – this will include but is not limited to Manufacturer, transport provider, warehouse providers and retail store.

- Visual checks for both pack and product can be carried out at either retailer or by the brand owner. In either case it must be noted that stock used for testing is not suitable for sale to consumers, therefore stock must be provided for the trials on an agreed basis between the retailer and manufacturer / brand owner.

- For finished product testing, samples should be taken from store or warehouse to simulate longest period held at -15C$^{o}$ These samples need to be representative of normal production and ideally taken from multiple points across a pallet to test for variance.

- For all products key testing is shelf life to assess whether a warmer environment affects the overall stability of the foods tested. Tests and parameters should be as today for different categories of foods but must consider the most sensitive products within that category to enable us to understand impact. Standard stable products should also be included for comparison.

Protocol:

- Company picks set of products from within their portfolio which meet either the standard product from category and/or high-risk products. These samples should be taken directly after production to ensure "true start of life" for effective shelf-life evaluation.
- Companies carry out shelf-life testing of product against a standard set of tests within their internal protocols:
    - This may include micro testing and virology testing, but this is not essential for this quality protocol.
    - Micro testing should be done using standard internal / external testing, but it is not necessary to include in the shelf-life quality testing as there is no perceived micro risk for frozen goods at -15C or lower.
- Shelf-life testing must include sensory testing.
- Other attributes according to product grouping from the additional attributes by freezer section should also be carried out as part of the testing protocol.
- All testing should be carried out at periodic time intervals across the current set shelf-life of goods but **must** include a check at end of life and one period beyond to show /confirm no change in degradation/drop off, of acceptable deviations. (nominal suggestion would be monthly / 3 monthly depending on total shelf-life)
- Each product will undergo abuse cycle testing at same periods within the testing cycle to mimic consume abuse at various stages within the normal storage and selling periods.
- Products should undergo a normal transport chain and be stored for shelf-life testing in store style freezers to mimic worst case scenarios.
- These freezers can be kept at the companies testing location rather than in store, but equivalent conditions of a retail store should be mimicked as closely as possible including storing for a period of time based on normal movement of the goods in store, frequent opening and closing of freezers held at -15C$^{o}$ to mimic consumer / store behaviors.
- Testing should be done at -18C$^{o}$ and -15C$^{o}$ (other temperatures are acceptable but please ensure these 2 set points are included) to create comparison with existing temperatures and impacts.
- Testing can be done in house against Company protocols or at a partner testing location such as a research or laboratory testing location.

  ***We encourage all companies undergoing this protocol to share data (anonymized or open) to the Move to -15C$^{o}$ coalition for inclusion in the overall study. All final data published will be anonymized for discussion with authorities and law makers.***

- On the following pages are proposed additional attributes by freezer category we could consider as consistent data in addition to the acceptable parameters of shelf life (which is unique to each brand)

| **Seasonal / Religious / Festival Specialities** | **Vegan / Vegetarian complex** | **Vegetables** | **Chips/Fries, Potatoes, and sides** | **Meat & poultry** | **Fish & seafood** | **Party goods** | **Baked goods including pastry filled goods (e.g., meat or fruit pies)** | **Pizza** | **Ready Meals** |
|---|---|---|---|---|---|---|---|---|---|
| Impacts which shorten overall shelf-life affecting production scheduling and delivery<br><br>Drying out of goods<br><br>Rancidity changes in fat-based goods. | Ice build up. Sensory changes from drying or too much water in final product from breakdown. | Ice build up (visual) Evidence of melding of vegetables into "clumps" with ice build up in between. Freezer burning of vegetables (visual) leading to "drying effect and poor sensory outcome. Sensory – against shelf-life expected quality (Company std testing) | Moisture changes affecting ability to crisp final product with customers or consumers.<br><br>Rancidity<br><br>Temperature and time changes for cooking instructions | Ice buildup from defrost refreeze impact leading to freezer burning and poor sensory.<br><br>Temperature and time changes for cooking instructions | Degradation Ice build up. Rancidity Drying out of product reducing sensory quality | Drying out of foods causing sensory unacceptability (Fruit, vegetables used as decoration) Ice build up. | Drying of product reducing sensory quality for the end consumers Fat separation resulting in sensory changes. Fat movement or water changes making pastry "soggy." Ice build up | Drying or burning of topping elements such as pepperoni or vegetables | Separation of layers in ready meals through drying or excess moisture build up. Changes to cooking times or temperatures to achieve same overall consumer experience. |
| **Fruit** | **Desserts e.g., meringues, cream or ganache based, cheesecakes etc.** | **Ice-Cream and Fruit ices** | **Gateaux or Cakes.** | | | | | | |
| Moisture changes leading to breakdown of fruit on defrost. | Drying out Surface cracking of cheesecakes or desserts leading to non- | Ice-crystals, Drying out of the ice-cream causing "crusting" or chewy | Drying out of the sponge or fillings Surface cracking of | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ice crystal formation. | acceptance by final consumer | sensorial impact. Sensorial changes due to temperature fluctuations Increased migration of flavours from packaging due to warmer temperatures. | frosting or icing. Moisture build up which causes the sponge to become unacceptably “soggy” on defrost. | | | | | | |

- 