DAIRY TRACEABILITY WORKING GROUP

Report B:

New Zealand Dairy Industry Best-Practice Guide to Proposed Regulatory Requirements for Traceability

December 2014

Table of Contents -

1 GENERAL INTRODUCTION

1.1 ABOUT THIS DOCUMENT

This document provides detailed guidance on how to develop a traceability process for participants in the dairy industry. Dairy Risk Management Programmes (RMPs), Food Control Plans (FCPs), and Food Safety Programmes (FSPs) and provisions in the Food Act 2014[1] require all participants to have a traceability process; following the guidance contained in this document and incorporating it into your dairy RMP will ensure that you are meeting current best practice. It is not, however, a mandatory Code of Practice.

Both the Animal Products Act (APA) 1999 and the Food Act 2014 require the dairy industry to manage food safety risks, including having a food traceability system in place. Under the APA the dairy industry is required to operate under a RMP and (from 1 March 2016) under the new Food Act. Dairy processors can also operate under a FCP if they sell to the New Zealand and Australian markets[2]. RMPs and FCPs are equivalent and are registered plans designed to identify, control and manage food safety risks. Under the Food Act some participants in the dairy sector eg dairy transporters will be required to operate under national programmes, which will require them to have systems in place and keep records but not operate under a registered plan.

Food safety legislation and regulation of the New Zealand dairy industry has long required participants in the industry to be able to track forward and trace back the flow of products through the supply chain, primarily through the implementation of the "one-up, one-down" system (ie knowledge of where inputs have been sourced and where products have been dispatched). The material contained in this document will extend current practice and assist industry participants to meet this requirement effectively and efficiently. A strong food safety culture includes having sound traceability processes embedded in your business.

This document is in three sections. In Section One, we cover context, background and the objectives and purpose of traceability. In Section Two, we examine the practice of traceability covering the principles and fundamental steps of a traceability process. In Section Three, we focus on the specific steps for best practice traceability in the dairy sector.

The central purpose of a traceability process is to enable the rapid location of products in the supply chain. That is a legal requirement imposed by the Ministry for Primary Industries (MPI), as the industry regulator, via RMPs or the Food Act 2014, to help manage food safety risk.

---

[1] For the purposes of this document, Dairy Risk Management Programmes (RMPs), will henceforth include Food Control Plans, Food - Safety Programmes and provisions in the Food Act 2014. -

[2] Currently some of the dairy industry are operating under Food Safety Programmes established by the Food Act 1981, which are - essentially the same as FCPs. -

Consumers are seeking more and more information about the products they purchase. Traceability is one of the tools that can provide some such information. Global trends are towards requiring increasingly detailed information about many aspects of the production process and supply chain. Many of New Zealand's trading partners are moving towards making the provision of such information mandatory.

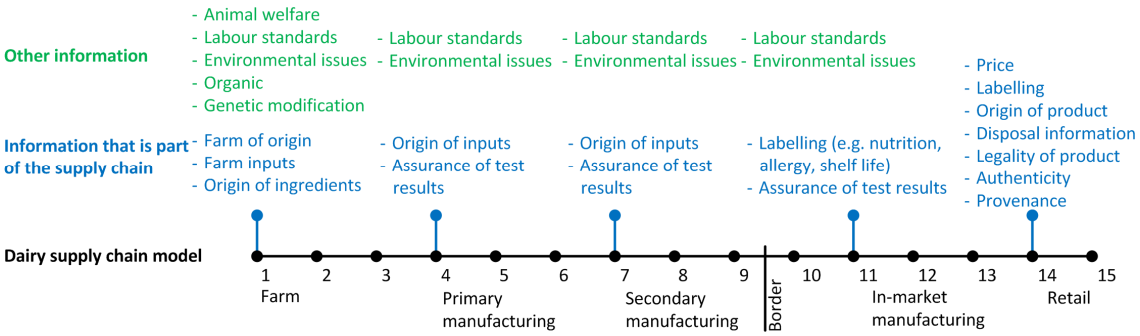


Figure 1. Examples of information required by consumers and the supply chain

The optimum design for a traceability process is one that would allow virtually instantaneous identification of the current location of every product in the supply chain from the source of every input to the ultimate consumer. Although there are some existing standards and technologies that may deliver this kind of supply chain visibility and traceability, "real-life" implementation of these is not yet widespread. Moreover, the New Zealand regulatory authorities have no power to compel New Zealand companies' offshore trading partners to participate in such a process.

Nevertheless, it is important that the New Zealand dairy industry has in place a traceability process that is a world leader. In practical terms, this means a process that is best practice fit-for-purpose for today and that establishes a sound foundation for future enhancements as technology, international best practice and global rule-making evolve.

It is intended that the proposals for revised traceability requirements and this document – the best practice guide – should be reviewed within three years after they are implemented.

1.2 FOREWORD

In August 2013, potential contamination in a batch of whey protein concentrate (WPC) threatened New Zealand's hard-earned reputation as a trusted supplier of safe and suitable food. Following the incident, the New Zealand Government set up an inquiry (the Inquiry) to investigate what happened and what lessons might be learned from the way it was managed. The Inquiry found that New Zealand's food safety regulatory model is consistent with international principles and among the best in the world. However, it recommended that consideration be given to strengthening the model further, in particular, to take into account international market trends seeking ever-greater confidence in the integrity and safety of food.

As this incident demonstrated, international trust in the quality and safety of New Zealand's primary products can be undermined if risks are not managed appropriately. Even a seemingly minor issue involving one product from one producer can influence much broader perceptions about the quality and safety of New Zealand's products, even those very different from the one at issue. It is accordingly in the interests of all producers to be constantly aware of risk and to ensure that they are adopting best practice ways of managing that risk and its impact as well as having in place appropriate response plans to cover all contingencies. It is also essential that these response plans be periodically tested.

The dairy industry presents some particular traceability challenges, due to the physical nature of the product, its continuous processing and the fact that raw milk is transformed into a wide variety of dairy products. Milk and its products may undergo one or more transformations in a single or in multiple plants. These may be solely in New Zealand or also overseas. Product may also be re-imported for processing, or, alternatively, sold in bulk or in final consumer packs. It may be a final product or an ingredient for further processing. Product may be exported to markets that have traceability requirements similar to those in New Zealand or to those that have few requirements or indeed, none at all. Thus, effective traceability processes need to be outcome-based and built on sound principles that can be implemented in a variety of environments.

1.3 INTERNATIONAL TRACEABILITY REQUIREMENTS

Set out below is a high-level comparison of traceability requirements in some of New Zealand's key markets.

Requirement	FSANZ[3]	Canada	European Union	United States
Mechanism	Food Standards Code	Safe Food for Canadians Act (and proposed regulations)	Regulation (EC) No 178/2002 on General Food Law	Bioterrorism Act
Traceability principle	One-up, one-down	One-up, one-down	One-up, one-down	One-up, one-down
How long records should be kept	Not specified	3 years	Not specified (but 5 years suggested in guidance)	Not more than 2 years
Minimum response time for information	Not specified	24 hours after request or shorter time limit specified if there is risk of injury to human health.	On demand.	As soon as possible, not to exceed 24 hours after request
Format of information	Not specified	In a format that standard commercial software can manipulate, or paper format, legible without external aids	Not specified	Any format

Table 1. Comparison of traceability in key markets

[3] Food Standards Australia and New Zealand

In addition to these legislative and regulatory requirements of some of New Zealand's key markets and partners, China is also moving towards introducing a new legal framework governing trade and commerce in dairy products. These emerging requirements may draw on similar provisions in markets such as the European Union and United States. When China chooses to implement these new requirements, New Zealand exporters will need to adapt to them as appropriate.

Similarly, consumers, retailers and trading partners are increasingly seeking information and assurances when making purchasing and/or import decisions. "Upstream" information from the final consumer product is necessary to satisfy this need for information. The information sought might also reflect values such as the status of animal welfare on originating farms, confirmation of organic status or application of labour standards (as referred to in *Figure 1* above). Best-practice traceability processes may assist industry participants in supplying such information when required.

1.4 Scope and Purpose of this Document

The Animal Products Act 1999 requires that dairy RMP owners can effectively identify and recall products that do not meet the legal requirements of the dairy RMP. A traceability process needs to operate continuously in order to enable these dairy RMP outcomes.

This document's intent is to outline the fundamentals of the traceability process, the traceability challenges with respect to the New Zealand dairy industry and a framework that participants can use to implement or enhance processes, such that traceability information is routinely captured and applied as part of day-to-day operations. It should be noted that the traceability processes set out in this document are not sufficient to prove product authenticity or prevent food fraud and/or counterfeiting, although a robust traceability process may act as a deterrent to such activities.

1.4.1 Scope

- This document is not a mandated Code of Practice for meeting regulatory requirements for traceability; it is an industry best-practice guideline intended to meet and exceed the proposed regulatory requirements for traceability
- This document sets out principles and approaches for the design, implementation and verification of a traceability process for the New Zealand dairy industry
- The principles and approaches set out in this document are based on the "one-up, one-down" principle and apply to the full supply chain, from the collection on farm through to the final customer where feasible (to the final retailer within New Zealand)
- The principles and approaches apply to all forms of trade in dairy products, including online sales and imported dairy products, whether finished or semi-finished[4]

[4] The principles contained in this document clearly apply to food service providers and other dairy food supply chain participants, but the means for implementing rigorous track and trace may be somewhat different and will be developed in a separate best-practice document.

- This document does not set out principles and approaches for product recall planning and/or execution, although the data used for traceability will support such activities
- The traceability process set out in this document is independent of any specific data management system or tracing technologies, although it does require the use of global data standards

1.4.2 Purpose of traceability

The processes outlined in this document will enable the New Zealand dairy industry to facilitate timely decisions based on accurate data of the source and location of dairy material, dairy products, ingredients and packaging[5] in the supply chain, including the legal requirement that requests for information must be responded to within stated time limits.

The primary purpose of traceability processes is to enable precise tracking and tracing of products through the complete product supply chain, in order to identify accurately products that may need to be further investigated.

The New Zealand dairy traceability processes will enable the management of risk by being able to facilitate timely decisions outlined here, based on accurate data on the location and quantity of food in the supply chain.

1.5 Objectives and Principles for Traceability

1.5.1 Objectives

The objectives of dairy traceability processes are to:

- Identify the quantity, source and location of dairy products in the supply chain
- Enable the meeting of relevant regulatory requirements

Traceability also enables processes of recall and/or withdrawal of product if not fit for purpose. It can also support market access and supply chain visibility. Best practice traceability processes may also enable other objectives, such as generating increased confidence amongst customers and end-use consumers or supporting claims about the authenticity of products, but these are of a secondary nature.

1.5.2 Principles

1. - The traceability process must have and must be seen to have integrity and reliability

2. - The traceability process must ensure timely access to traceability data to achieve the desired results within there required time of the regulator

3. - The focus should be on identifying all Critical Tracking Events (CTEs) and Key Data Elements (KDEs) required for rapid analysis and identification of product moving through the supply chain

[5] Dairy material, dairy products, ingredients and packaging will from henceforth be referred to as dairy product.

4. - Traceability record-keeping must be reported and shared on the basis of a valid request from regulators or trusted participants

5. - When traceability data is required, it must be shared electronically in a timely manner[6]

6. - For purposes of reporting, traceability data should be directly usable and intelligible to upstream and downstream participants

7. - Traceability requirements should be outcome-based so that individual enterprises can adopt processes and procedures that make good business sense for their particular circumstances

8. - Any traceability process employed should use global data standards to assist interoperability across all market participants' systems and processes

1.6 Change History

Date of current version	Date of previous version	Section changed	Change(s) description
December 2014 -			Draft for Dairy Industry Review

1.7 Contact Details

1.8 Disclaimer

1.9 Acknowledgements

The Dairy Traceability Working Group acknowledges: the Innovation Centre for US Dairy: portions of this traceability best-practice guide are based upon "Guidance for Dairy Product Enhanced Traceability", 2013.

[6] Electronic data gathering and storage are the preferable method to be used.

2 TRACEABILITY AS A PROCESS

2.1 INTRODUCTION

New Zealand needs to ensure its traceability regulatory requirements and systems are consistent with international best practice, cost-effective, technically feasible and able to handle increasingly complex supply chains. Systems that meet these requirements will provide enhanced food safety and assurances for food products to New Zealand's export markets, overseas regulators, customers and consumers.

Food safety, and therefore traceability, is a public good and in the common interest. By the time an item is purchased, consumed or used, it may have gone through a number of processes and channels. Each may have involved a number of different parties. In addition, the export product crosses geographic borders at least once in its life cycle, subjecting it to multiple requirements – both regulatory and commercial.

New Zealand-specific or regulator-specific solutions are inadequate in a global market for New Zealand products. All supply-chain participants – 'upstream' and 'downstream' in the supply chain – need to work collaboratively in order to achieve the required level of traceability that will enhance food safety and provide the visibility that consumers and customers are increasingly requiring.

Achieving these goals necessitates a genuine public-private partnership. To establish an agreed and shared requirement, individual organisations, the sector and regulators must create interoperability in key minimum standards of traceability across the whole supply chain, while accommodating their specific business, industry sector and regulatory requirements.

2.2 TRACEABILITY FUNDAMENTALS

Traceability management across the supply chain involves the association of a flow of information with the physical flow of traceable items (*see Figure 2*.) Each participant must perform different roles within the supply chain, but all participants must follow the basic steps agreed to in the traceability process.

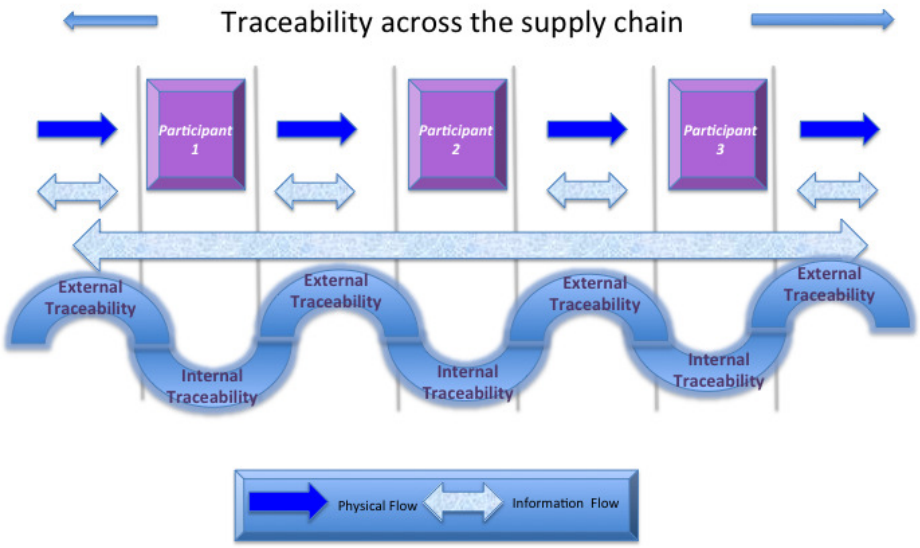


Figure 2. Simplified traceability model

Traceability covers all participants in a supply chain, from inputs on the farm to final consumption of the product by a consumer or disposal by any participant in the supply chain. There is both a physical flow of traceable product, packaging and any related items, and an information flow of traceability data.

For example, the following products may be within the scope of a traceability system:

- Any input to animal or plant agriculture, (eg feed, pesticide)
- Any cleaning or manufacturing aids used in production
- Any individual product destined for human consumption, (eg a carton of milk)
- Any ingredient used in a multi-ingredient food, (eg cheese etc in a pizza)
- Any item of packaging used in contact with a product, (eg a glass bottle, a tin, a scoop in the tin, a bag for milk powder)
- Any packaging material used for final consumer packs
- Any finished manufactured product, (eg a batch of ice cream)
- Any shipping materials (trade item), (eg outers, carton)
- Any logistic unit, (eg a tanker of milk)

All dairy supply-chain participants involved in the physical flow and/or information flow (eg tanker, dairy factory, importer etc) are involved. Traceability participants can be traders or non-traders in the chain. To illustrate, an importer may never take ownership or possession of a shipment but may have a responsibility to regulatory authorities as the "person responsible" for the traceable item. Others that are not directly involved as trading participants in the supply chain include verification bodies and competent authorities.

While maintaining traceability is generally the responsibility of the participant with "possession, custody, or control" of a traceable dairy item, in some instances other participants may also have responsibility. Two levels of responsibility can be distinguished:

- **Primary responsibility:** Typically importers, producers, processors, manufacturers, or distributors, retailers and providers who are responsible for the specification and content of products, and traceability requests. They are each responsible within the limits of the activities under their control
- **Secondary responsibility:** Typically transporters, carriers, ship owners, storage companies and logistics providers that work on behalf of the organisations with primary responsibility. Those with secondary responsibility must create, capture, record and share data about the identity, location, quantity or relevant traceability data as required that is in their care

2.3 TRACEABILITY PARTICIPANTS: PARTIES AND ROLES

In traceability, it is essential to distinguish between *parties* and *roles*. This because supply-chain participants have responsibilities that depend upon the role they play:

- A *party* is, broadly, a legal or physical entity (eg a retailer such as Tesco or Countdown, or a dairy manufacturer such as Fonterra)
- A *role* is a specific function of a party in a specific process at a specific time (eg a buyer and a brand owner)

A party can have more than one role. For example, a dairy manufacturer (ie the party) can act as a seller of items and also as a buyer of raw materials (ie in two different roles).

The tables below indicates the different types of parties and roles in the dairy supply chain.

Party	Description of Activities
Manufacturer/dairy facility/dairy processor	Receives raw products (ie milk) and other ingredients, packaging etc. Creates, processes, packages, labels, stores, sells, ships dairy materials and products etc.
Supplier	Provides materials to manufacturer. Farmers are suppliers in this traceability example, as are packaging providers and ingredient providers. Similar to the manufacturer description above, suppliers also produce, process, contain, store, sell material and products etc (ie are manufacturers).
Authorities	Customs bodies and other regulators with compliance oversight. Officials legally mandated to protect the public interest. New Zealand examples include Ministry of Primary Industries (MPI) and FSANZ.
Transporters and third party logistics	Truck/rail/ship/air services that receive, ship and deliver dairy material and products, but do not own them and do not transform them.
Retailer/ food service provider	Parties that have the final relationship with the end consumer eg convenience stores, supermarkets, grocery chains, restaurants, food service providers such as hospitals or prisons, and e-tailers, such as Amazon.

Table 2. Parties in traceability

Role	Description of Activities
Brand owner or licenced brand user	The party responsible for allocating traceability identification.
Traceability participant (receiving data)	Any party identified above – suppliers, manufacturers, transporters, distribution centres etc – who is authorised to read, use and download traceability data (such as receiving raw input materials).
Traceability participant (providing data)	Any party identified above – suppliers, manufacturers, transporters, distribution centres etc – that provides, or is a source of, data (such as dispatching finished product).
Traceable item recipient	Any party with primary responsibility – suppliers, manufacturers, distribution centres etc – that takes possession of a traceable item

Table 3. Roles in traceability

By the time a dairy material or product is used, purchased or consumed it may have gone through a number of events and transformations. Each event or transformation may have involved a number of different parties. Every party has a responsibility to manage traceability and must follow the basic agreed-to steps of the traceability process.

An organisation that is not physically handling any products but that has a legal or contractual responsibility towards the products (eg a brand owner of contract manufactured infant formula, or a broker who does not physically handle the product) may still be involved in traceability requirements for the information flow. For example, the brand owner must be able to respond to a trace request concerning the contract-manufactured infant formula details. A schematic example of how roles and parties interact across the supply chain to enable traceability is provided in *Figure 3.*

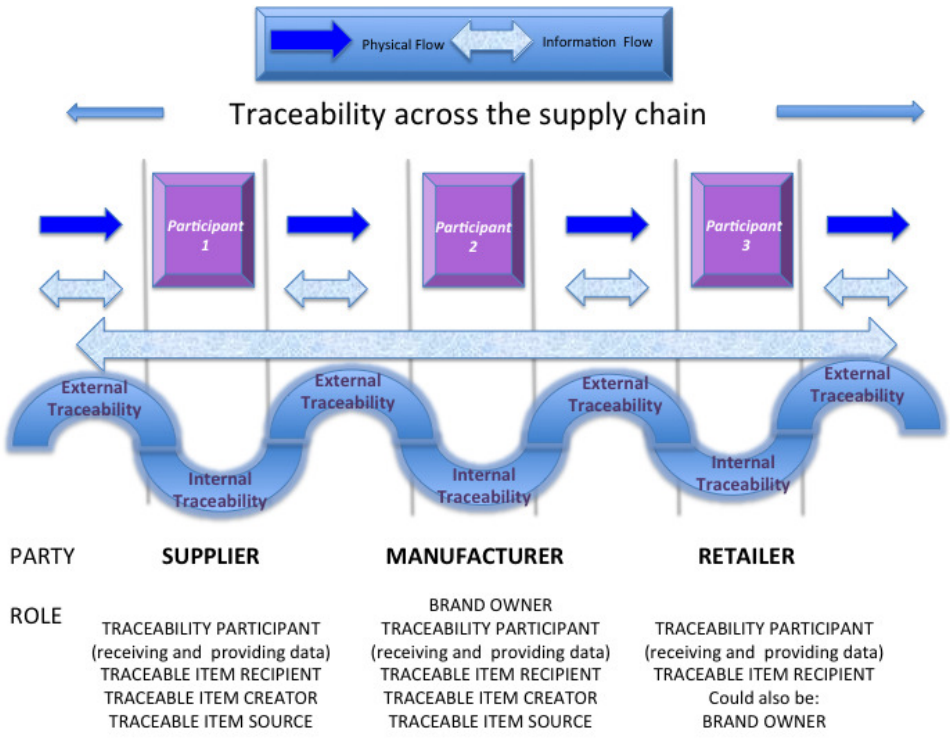


Figure 3. How roles and parties interact across the supply chain

2.4 TRACEABILITY BOUNDARIES

For the purposes of this document, it is assumed that the traceability boundaries of an organisation encompass a physical area where product is transformed and/or moves between processing units in bulk (eg in a pipe or by conveyer). Movement of product through a processing unit or further down the supply chain where the product is in discrete units (eg 25kg bags or on pallets) is considered an external process, even if the movement is within the same physical site. It may therefore be the case that there can be more than one traceability party at the same physical site.

2.4.1 Internal Traceability

Internal traceability always takes place within a traceability participant's organisation and involves the physical flow of products that the organisation receives, processes and dispatches, and the related information flows. Events when traceability data should be collected consist of one or more of the following processes:

- **Receiving:** All items crossing the boundary from an external party or supplier to the processing unit. The traceable item received could be, for example, raw materials, ingredients, packaging or finished products
- **Movement:** The physical relocation of an item. Traceability records of movement may help identify the impact of quality failure such as incorrect storage temperature or damage during relocation
- **Transformation:** There are three different transformations:
    - Physical transformations have the potential to change the characteristics of the product eg whole milk being separated into skim and cream fractions, packing bulk infant formula into retail units, instantising powder with soy lecithin
    - Informational transformations, (eg varianting or downgrading a product, splitting up a batch, a quality status change, a product on hold, or withholding periods for animal compounds and veterinary medicines)
    - Transport transformations are different from movements, as item that is being traced will have altered status in some form. This will change the nature of how the product is identified, (eg a change in type of transport (from road to sea) or pallet to container etc.)
- **Storage:** Holding an item at a location within the organisation
- **Usage:** Using (and recording) resources, facilities and equipment (eg heat treatment operator testing a divert system; a cold storage facility; a silo or tanker)
- **Destruction:** A contaminated product etc.
- **Dispatch:** All items crossing the traceability boundary to a further processing facility, external party or customer to the organisation. The traceable item dispatched could be, for example, an intermediate product

It is understood that each organisation may have its own process or processes to identify and track its dairy materials and product through its internal manufacture, movement and/or transformation. The internal traceability boundaries of an organisation encompass a physical area where product is transformed and/or moves between processing units in bulk. Thereafter, the identifier and the associated data elements must be globally unique (see section 3.4.7.6). For those organisations that currently do not have any processes in place, or are looking to standardise their

processes, this document recommends the use of global data standards to capture the data that links inputs during a product's internal life cycle.

Every traceability participant has a responsibility to maintain agreed data that links an input through a transformation process to the output, and links the original and final location after movement or transportation.

2.4.2 External Traceability

External traceability takes place when instances of a dairy product or material are physically handed over from one traceability participant (a source) to another (a recipient). Traceability participants will trace back to the direct source and track forward to the direct recipient of the traceable item ('one step up, one step down' principle).

For any given product's supply chain, traceability participants must be able to share common traceability data that enables identification of traceable items within their respective systems. All traceable items must carry identification allocated to them at source.

The brand owner must use unique identifiers based on global data standards to identify dairy materials/products. Where sub-contractors, and/or third -party transporters and logistics providers or others are involved, it is up to the brand owner to ensure the unique identity remains evident throughout all processes – this is usually specified within the relevant contracts.

2.5 TRACEABLE ITEMS

It is important to note that external traceability extends to all aspects of delivery from the dairy facility. Dairy product and materials are delivered in a wide range of logistic units. A logistics unit is an item of any composition established for transport and/or storage that needs to be managed through the supply chain. Examples include bulk bags, cartons, trays, crates, pallets etc. External traceability applies to any physical item where there may be a need to retrieve information about its history, application or location.

A traceable item may be a:

- **Shipment** – for example**,** a truckload, a vessel, 10 pallets of various items. A shipment may contain one or more logistics units (say a vessel with containers of whole milk powder)
- **Logistics unit** – a tanker, pallet or container. A logistics unit may contain other logistics units (eg containers that have pallets of whole milk powder inside). A logistics unit may contain one or more dairy materials (eg skim milk powder and whole milk powder pallets in a container)
- **Trade item –** Any item that may be priced, ordered or invoiced eg a 25kg bag of whole milk powder or a single can of infant formula. Trade items can also be items that are not crossing the point of sale, eg a carton or a bag that is ordered to enclose or wrap a product. Trade items can be very varied. For example, all the items below shown in *Figure 4* could be trade items.

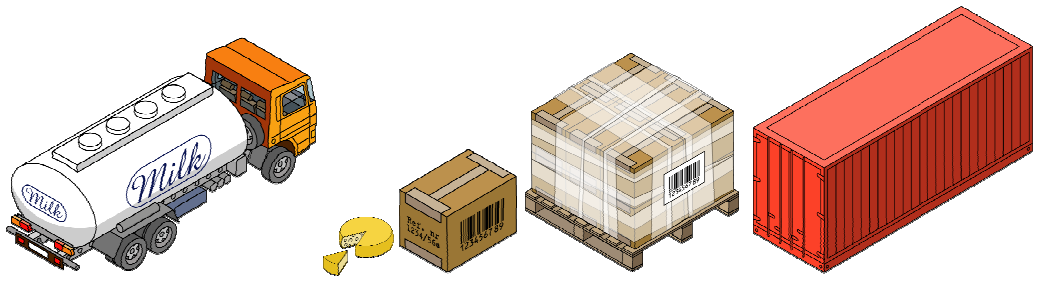


Figure 4. Examples of various trade items

- **Any other item** (that the traceability participants agree is a traceable item)

2.6 TRACEABILITY DATA

Accurate and consistent data is central to traceability. The use of unique identifiers which can be traced through the entire production flow, linking all sections of the dairy facility and its suppliers and customers through the supply chain require a standardised process and standardised data.

Critical Tracking Events (CTEs) establish the processes and path of a product through the supply chain. The corresponding Key Data Elements (KDEs) are the standardised pieces of data that document and record each CTE.

CTEs are events in a business process where traceability data must be captured and recorded in order to allow for effective traceability of products in the supply chain, both internally and externally. This includes those instances where product is accumulated, moved between facilities, is transformed, or is otherwise determined to be a point where data capture is necessary to trace a product.

For each CTE there will be an associated set of KDEs. The key data elements are the data pieces captured and stored during a CTE that describe the who, what, when, where and what happened (why) of the CTE:

- **Who?** = which participant
- **What?** = identifying the traceable item
- **When?** = date / time data can be planned, expected or actual. It is usually the actual date that is relevant
- **Where?** = what location
- **What happened?** = identifying the process or event

2.6.1 All dairy supply-chain participants must maintain agreed data

Every traceability participant has a responsibility to maintain agreed data that links an input through a transformation process to the output, and links the original and final location after movement or transportation.

2.6.2 A unique identifier for every internal and external traceable event

Every CTE will have KDEs. Dairy facilities will assign and identify each traceability event by a unique identification when recording a CTE. All subsequent event owners will capture and report the same identification for events related to that same item.

If the information is required by the market or by an external participant, the identifier and the associated data elements must be **globally** unique[7].

For internal traceability, having globally unique identification is considered best practice, because boundaries of a business may change as the business structure or manufacturing processes change, and other traceability participants may need to have a view on the data for their customers' needs (eg a retailer). Generally, the use of the same data standards is to be encouraged (ie a global data standard), to avoid transcription errors and optimise effectiveness and efficiency[8].

When a dairy product or material is co-mingled and/or later transformed into a new dairy product or material, the event owner who co-mingled/transformed it will replace the existing identifier with a new item identifier. That identifier would be reported for all CTEs related to this item until the item is once again co-mingled/transformed into a final product or depleted.

2.6.3 Interoperability of data in dairy traceability

Planning for interoperability allows all traceability participants to communicate their traceability data in a standardised and transparent way. Standardised interfaces (protocols for two-way communication) are therefore necessary for sharing traceability event information. The importance of having consistent data cannot be understated and must be leveraged across all systems. Standardised data elements, formats and standards for data exchange are essential for conducting successful track forward and trace-back investigations.

2.6.4 Labelling dairy products and materials

Identification is crucial to any traceability system. The usual way of making the identification of an item available to others is via a label. There is a wide range of methods available, from handwritten labels to technology such as radio frequency identification (RFID) that facilitates highly automated and detailed data capture, but the most common industry practice is bar coding. The product's unique identifier is the 'key' and that key that connects the products and the information flow for all participants.

2.6.4.1 Use of lot numbers

All dairy facility operators must assign lot numbers to products they create. When crossing an external traceability boundary, these must be linked to globally unique identifiers (eg a Global Trade Item Number, GTIN).

---

[7] An example of best-practice data standard for globally unique identification is the GS1 Global Trade Identification Number (GTIN).

[8] Stock-keeping unit numbers (SKUs – company-unique product references), or purchase order numbers are not unique lot identifiers and using these for traceability is strongly discouraged. This is because there is no guarantee of uniqueness or standardisation of data structures and such practices can obscure the visibility of a product as it moves through the supply chain.

Care should be exercised to ensure that any lot identification regulatory requirements are met. The best before or expiry date and the lot number, are the minimum requirements, but some suppliers also assign a unique serial number (see below) to each item or carton.

2.6.4.2 Human-readable v machine-readable data

Human-readable data on labels, while necessary for many point-of-sale or service activities, are limited in the amount of information that can be captured and shared for traceability purposes. A combination of machine-readable data and human-readable elements is best-practice; in order to accommodate all of the traceability data needs in the most efficient manner. The combination of human and machine-readable data will be of particular use for dairy ingredients suppliers, where the dairy products face extended global supply chains. It is also important where dairy products ultimately are, or become, components of, variable-measure, variable-price and food service or store-processed items, as it will aid in the ability to capture traceability information electronically as product flows from the original source through to secondary brokers, processors or manufacturers, retailers and to the end consumer.

Even though some external traceability participants such as specialist logistics participants have the tools to interpret data found in a machine-readable bar code or RFID chip for traceability data and identifiers, it is not a substitute for clearly labelled human-readable data.

Human-readable data must be shown along with the machine-readable symbol. The characters should be clearly legible and must be obviously associated with the symbol. See the examples below *(Figure 5)* for clarification.

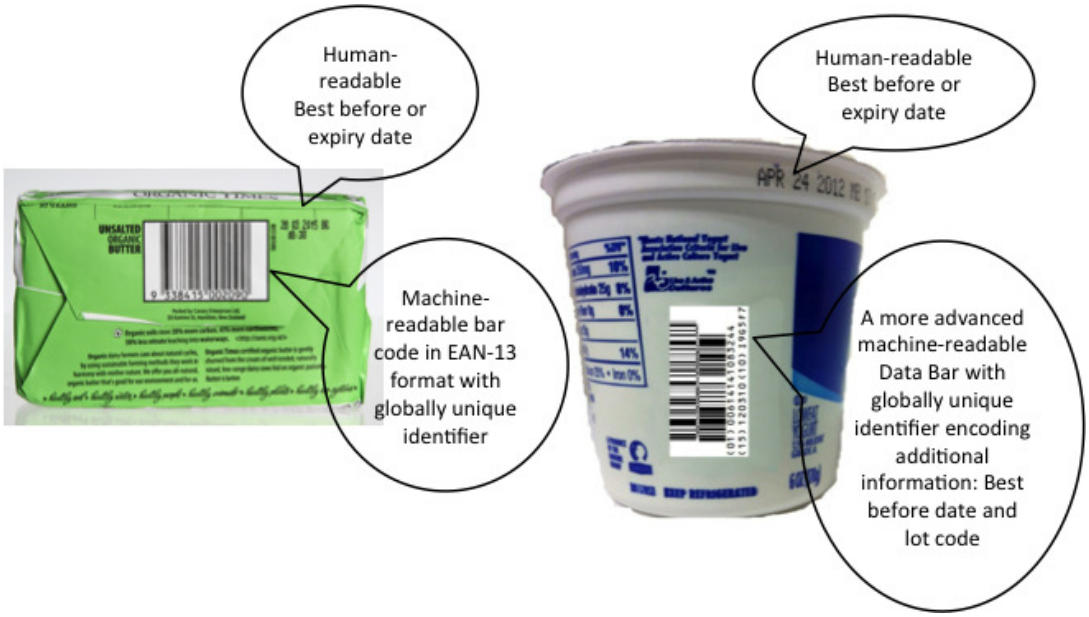


Figure 5. Examples of machine and human readable data

2.6.4.3 Use of unique serial numbers

A unique serial number is assigned to one item only and is thus different to a serial number assigned to another item. This allows unique, accurate and specific

identification of individual items. Globally unique serialised identifiers are best practice for items that will be consumed by vulnerable or special-needs customers (eg serialised Global Trade Item Numbers, GTINs).

2.6.5 Master data and transactional data relating to a traceable event

Traceability data can be classed as either master or transactional data relating to a traceable event. In developing traceability systems, considering whether it is master or transactional data is important so that participants will have access to the pertinent details necessary to ensure tracking and tracing.

Master data is relatively consistent over time and independent from day-to-day events. Transactional data describes time-bound events (usually lot data, delivery, price, allowances and charges, messages related to orders, dispatch, transport receipt and payment for the goods supplied – see *Figure 6*).

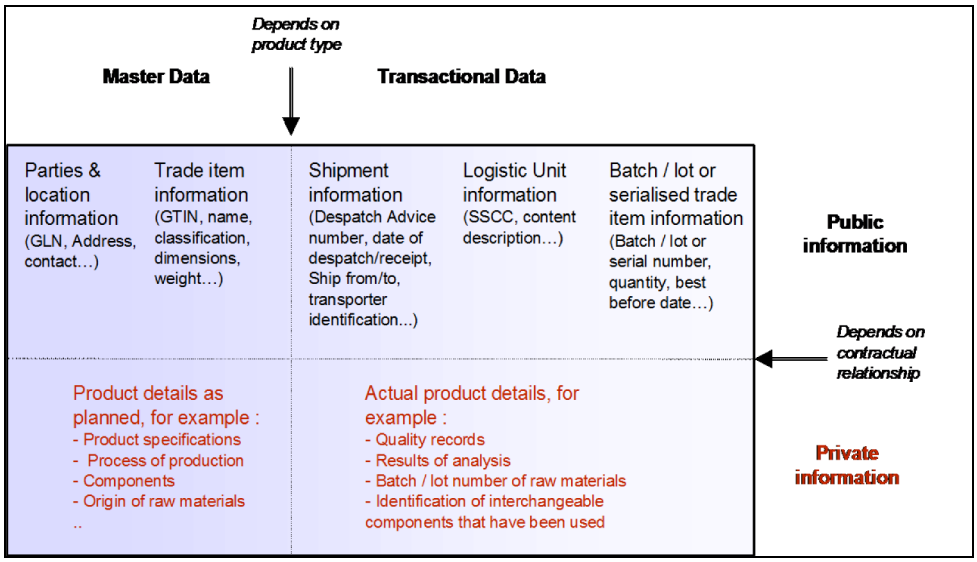


Figure 6. Master and transactional data

Traceability does not imply that traceability participants must hold and share **all** traceability information, but they must all have the ability to access **relevant** information, and share the agreed information required without infringing the intellectual property of each traceability participant. This ensures that the passage of items through the supply chain can be tracked and traced and accessed if needed.

2.6.6 The use of traceability data

Traceability data may address a formal inquiry about history, use or location of a traceable item. Any traceability participant (eg a customer or producer) may, within legally and commercially acceptable limits, initiate a trace request.

There are many types of trace requests. They depend on the specific business need and use of the information. Examples include:

- What are the ingredients of this traceable item? (eg an inquiry about possible allergen which is not mentioned on the label)
- Where are these traceable items located? (eg an inquiry about the status of delivery or

of product recall)

- Which traceable items have been created using this specific traceable item pallet of origin or batch of raw material? (eg to facilitate product withdrawal)

2.7 TECHNOLOGY OPPORTUNITIES AND DEVELOPMENTS

The New Zealand Data Futures Forum in its 2014 report recommends that New Zealand should create competitive advantage by developing "a high value, strongly inclusive, high trust and control data sharing eco-system."[9]

The report singles out the primary sector in general, and traceability in particular, as a high-value area for such an ecosystem.

Developments in technology are likely both to enable more efficient and more cost-effective approaches to traceability, as well as leading to increasing demands for greater transparency and real-time access to supply-chain information by regulators, customers and final consumers.

Increasingly, data are likely to be collected and stored once and once only, but used by a number of trusted and authorised users. Such users will expect ready access through interoperable systems to data in standardised global formats, to be used as required.

Best practice in traceability is moving rapidly towards the use of Electronic Product Code Information Service (EPCIS) standards[10]. Internationally, EPCIS is being promoted by inter-governmental organisations such as the Asia-Pacific Economic Cooperation (APEC) forum, World Customs Organisation (WCO) and North East Asia[11] Logistics Network (NEAL-Net). It is also being piloted for traceability – notably in the seafood sector in many economies in the European Union and with the United States authorities as a distributed approach designed to ensure systems can reliably and efficiently share information between and within all traceability participants, including competent authorities. This reinforces the need for all dairy-industry participants to move to adopt standard global formats for their traceability data elements.

The best practices discussed are not meant to imply immediate investment and/or implementation for traceability effectiveness. Rather, they are meant to provide a view toward future opportunities for planning purposes and adoption as soon as is commercially and technologically practical. Discussion with your supply chain partners is encouraged so that appropriate functionality can be included as plans are made for future system upgrades.

[9]https://www.nzdatafutures.org.nz/sites/default/files/NZDFF_Key_recommendations.pdf -

[10] EPCIS is an international standard that establishes the types of data supply-chain participants use in common – the what, when, - where and what happened and stipulates the format used in creating the data. By requiring a standardised data format, EPCIS - enables traceability data on servers to be shared and understood among all participants. In effect, it creates an "internet'" of the - traceability data. Instead of a centralised database, EPCIS is a distributed network that supports shared access to data on multiple - servers, in which each participant can manage the traceability data they generate. EPCIS is also agnostic as to data input – it can be - manually entered, barcoded, RFID, etc. -

[11] Korea, Japan and China. -

3 HOW TO BUILD THE TRACEABILITY PROCESS – DETAILED GUIDANCE

This section covers in detail the process to create dairy traceability and some important considerations that are useful as you develop a traceability system.

3.1 THE NEW ZEALAND DAIRY SUPPLY CHAIN

A useful starting point is to model the dairy supply chain in two ways: by the physical events that indicate the steps from raw inputs to a finished product used by the recipient; and by the chain of processes that add value to the finished product. Both are relevant because they highlight different aspects of traceability, the parties involved and the key tracking events.

3.1.1 Model one: Physical supply chain – a simplified version

Mapping out the physical supply chain assists in identifying all the CTEs happening within the supply chain. A simplified version is presented below *(Figure 7).*

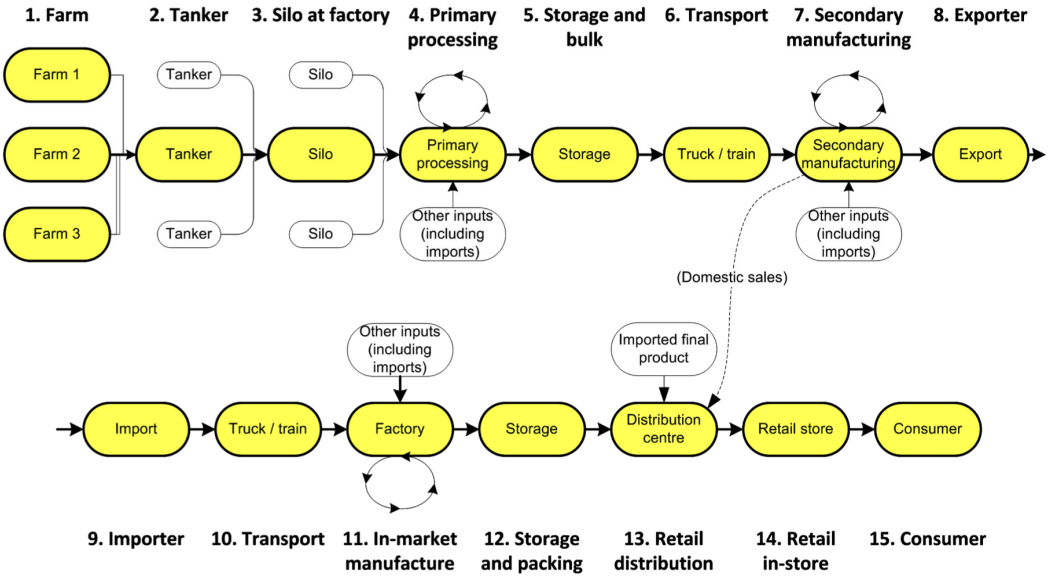


Figure 7. Physical supply chain

In practice, dairy supply chains can have additional complexities such as the repetition of steps or multiple import/export steps and are rarely as linear as this simplified scheme suggests. Further, some supply chains will have fewer steps than shown above. In addition, MPI and other agencies and jurisdictions have oversight of the supply chain.

3.1.2 Model two: Value chain

The value chain describes "the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer. The activities that comprise a value chain can be contained within a single firm or divided among different firms. Value-chain activities can produce goods or services, and can be contained within a single geographical location or spread over wider areas".[12]

This perspective is also useful to highlight the CTEs that happen across the whole supply chain, which, in the case of dairy, often has many roles and parties. An example value chain is presented in *Figure 8* below.

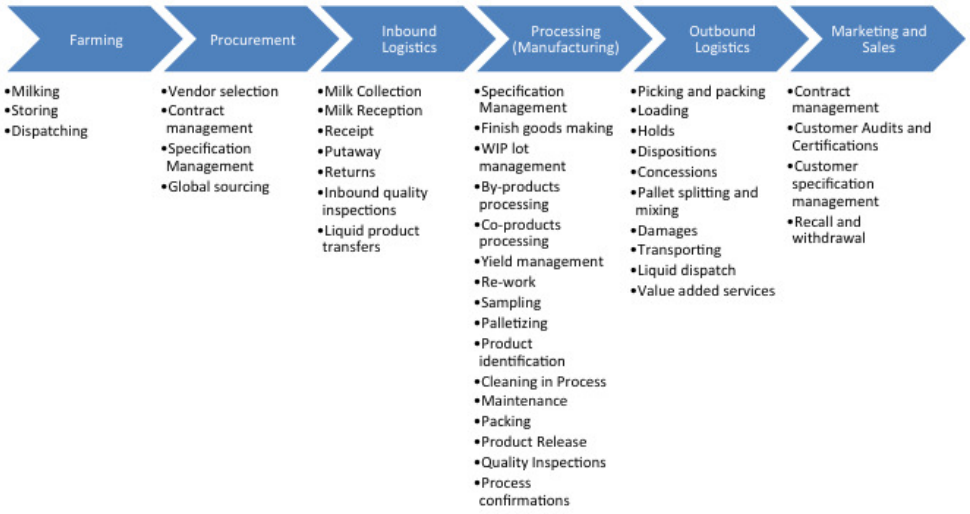


Figure 8. Value chain model

3.2 Traceability as a Component of Risk Management – a Key Requirement of the Regulator

Dairy processing is regulated by the Animal Products Act 1999, which focuses on the processing, primary and secondary production of animal material and animal products under an approved dairy RMP. The Animal Products Act regime places responsibility for risk management on producers, processors and storage and transport operators and aims to give industry the flexibility to innovate, provided outcomes are met while continuing to assure food safety. Dairy product manufacture can also take place under the Food Act.

Industry must operate under RMPs that are specific to a particular operator's business, setting out how that operator will identify, control and eliminate hazards and other risk factors in its production, processing and transportation of safe food. RMPs also set out processes with respect to record keeping and product recall.

[12] Source: http://www.globalvaluechains.org/concepts.html

3.2.1 Export requirements

Exported dairy product, depending on the destination, requires an official assurance from the New Zealand government to the government of the destination country (or region). The destination country may have additional requirements that apply to product exported to them. Export certificates are issued on the basis of a verified chain of custody within New Zealand on the basis of specific regulations. This official assurance is usually provided by way of an official electronic certificate issued under the auspices of MPI (through the MPI E-cert computer system). The certificate provides official assurance that the product in question is eligible for export to the specified market. Because it is based on a verified chain of custody, it also provides substantiation to support provenance and authenticity claims within New Zealand.

3.3 ALIGNMENT WITH HACCP

Dairy facility operators will find convenient an alignment between CTEs and HACCP (Hazard Analysis and Critical Control Points), which will be useful for the purpose of mapping out their CTEs. Be aware, however, that HACCP flows are not comprehensive – you will also need to consider the steps before and following HACCP documentation as well.

HACCP	Product Traceability
Conduct a hazard analysis	Identify products and product inputs to be traced
Identify critical control points	Identify critical tracking events
Determine critical limits	Determine key data elements
Establish monitoring procedures	Establish data capture procedures
Establish corrective actions	Establish a system to correct “red flags”
Establish verification procedures	Verify traceability process
Ensure record-keeping	Maintain accessible records to track forward or trace back CTEs.

Table 4. Alignment between HACCP and traceability processes

HACCP process flows typically consider aspects relating to internal traceability; a review will be needed to illustrate process from a one-up and one-down perspective. They also tend to have more details than will be required for CTE identification and it is permissible to group the HACCP flow steps into the CTEs for traceability purposes.

Some facilities will have multiple production areas, manufacturing different types of products like cheese, powder and butter. For traceability purposes, it is recommended that these be mapped as individual facilities.

3.4 PROCESS STEPS FOR TRACEABILITY

This section will guide you through the basic steps to achieve a robust traceability process. A high-level overview of the process includes:

Step 1: - Establish the high-level objectives and scope of your traceability accountability

Step 2: - Review risk, safety and quality management and processes that are required to support a full traceability process (eg RMP, Quality Management System, determine the appropriate lot size, etc.). In practice, these are likely to be developed in parallel, given their interdependencies

Step 3: - Form a multi-disciplinary team that can cover the scope of the traceability accountability, ensuring you have 'in the room' all those with relevant authority and responsibility, etc.

Step 4: - Define the desired outcomes of the traceability process (eg system (eg timeliness, accuracy)

Step 5: - Map the entire process from your suppliers to your customers (one step backwards, one step forwards) – both product and information flows

Step 6: - Establish boundaries of internal and external traceability

Step 7: - Identify the type of event – movement, transformations, storage, usage and destruction

Step 8: - Agree with all your traceability participants the protocols for data capture, storage and exchange:

- How you will supply data to downstream traceability partners (both master data and transactional data)
- How they will supply to you both master data and transactional data (eg electronically)
- What data – and particularly, your unique lot/product identification will be recognised
- How traceability information will be created, stored, maintained and shared

Step 9: - Agree with stakeholders how the traceability system will be verified and tested

Step 10: - Implementation of the processes including documentation, records management, training and validation etc.

These steps are outlined in detail below.

3.4.1 Step 1. The high level objectives and scope of your traceability system

The fundamental drivers for having a sound traceability process are to ensure compliance with regulatory requirements, meeting customer specifications and needs and protecting your brand and reputation in the markets in which you operate. There is also a broader public good requirement to ensure New Zealand's product and market reputation is preserved.

The scope of dairy traceability in the regulations requires traceability practices from activities ranging from the farm collection to the point of product depletion, including:

- Procurement of all ingredients and inputs
- Product creation (including all inputs)
- Product transformation
- Product shipping and transportation
- Product receipt, storage and handling
- Product unit depletion (consumer sale/consumption/disposal).

This applies to all New Zealand distribution-channel participants, including manufacturers, processors, contract packers, brokers, suppliers, importers, exporters, wholesalers, distributors, food retailers, foodservice operators, and third-party providers, such as freight forwarders. This also means that traceability requirements apply to packaging in contact with the product.

All traceability participants in dairy facilities and distribution channels should be able to identify the direct source, ie all the suppliers (backward, or up-stream) and direct recipients (forward, or down-stream) of traceable items. This is the "one-step up, one-step down" principle, which requires participants to collect, record, store, and share agreed data for traceability.

Dairy facility operators should define the scope of their traceability system before developing it. In New Zealand, the traceability requirement is composed of the following three elements:

- **Upstream (supplier) traceability**: Identification of the suppliers of all inputs, which may include processing aids and packaging to the dairy facility operator
- **Process traceability**: Identification of any dairy material, dairy product, all the inputs (including processing aids) through the operations within the dairy facility operator's establishment/s, whether or not new products are produced
- **Customer traceability**: Tracking the food leaving a dairy facility operator's organisation to the immediate customers receiving it

3.4.2 Step 2. Review risk, safety and quality management systems

Before you start developing your traceability system, it is expected you will have reviewed your quality management system, dairy RMP and related programmes, documentation and record-keeping controls. There are two related concepts for dairy facilities operators that must be agreed early (prior to developing your outcomes), as they impact data collection throughout the process: these are *data granularity* and *optimal lot size*.

3.4.2.1 Levels of data granularity

In general, the power of a traceability system is related to the precision of identification (its *granularity*).

Varying levels of data granularity about lots and finished products are feasible, depending upon regulatory requirements, commercial risk, public liability, continuous improvement and market requirements. A balance must be struck between the complexity and workability of a traceability system (thus cost) and the smallest realistic safe lot size.

3.4.2.2 Optimal lot size

For food safety purposes, a lot is defined as a quantity of material produced under consistent process conditions. Dairy facility operators must determine an acceptable level of commercial and reputational risk (or that of their customers).

Best practice traceability processes require that an optimal lot size is defined for each CTE such that the output is effectively linked to its inputs one-up and one-down. These lots need to be sized to meet the traceability timeliness and accuracy requirements defined in traceability process (Step 1 above).

When considering traceability and your regulatory obligations, careful consideration needs to be given to the optimum size of your lot; competent authorities will consider all dairy product unsafe from a whole lot, or consignment of the same class or description. unless proved otherwise.

Additional features regarding the size of the lot that may need to be considered:

- Product type and characteristics (final product or ingredient, homogeneity ie uniform character and quality within specified limits)
- Intended use of the product, for instance, infant formula
- The food safety risk of the food, taking into consideration data collected by regulators
- Other quality risks
- Size and value of the production run
- Previous demonstrated process ability to meet compliance requirements re the dairy facility operator's capability to manage traceability and risk
- Natural or engineered "breaks" in the production process, including cleaning
- Commercial risk including reputational and brand risk

Note that within a continuous flow process, smaller lots for traceability purposes could be determined by specific events within that flow, eg a CIP programme.

In general, the greater the potential impact of a food safety incident involving the product, the greater the amount of traceability information to be provided. This is illustrated in *Figure 8* below, with low risk / low impact products at left and high risk / high impact products at right.

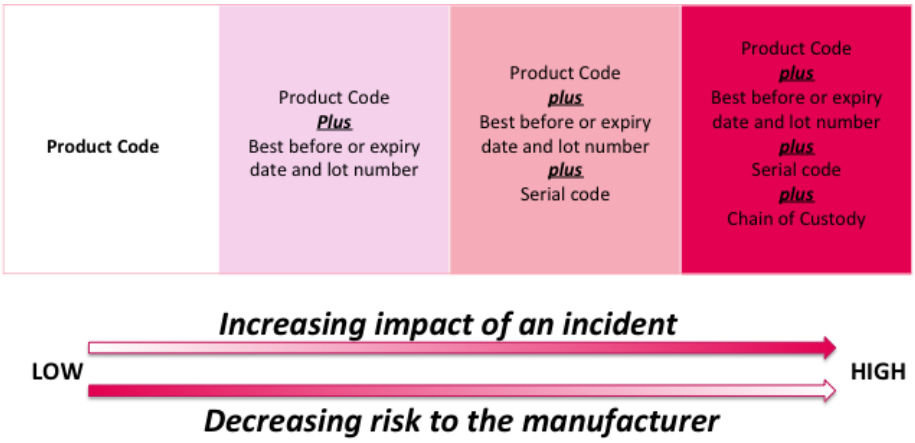


Figure 8. Levels of product identification to manage risk

By providing more detailed data, the risk to the manufacturer reduces from left to right and the inclusion of additional information such as a serial number or tracked chain of custody could reduce the amount of stock requiring quarantine, assuming all participants in the supply chain have a similar capability. In products that have higher risks (such as paediatric formulations), more traceability information provides additional levels of assurance.

3.4.3 Step 3. Forming your team

The team needs to be multidisciplinary and includes stakeholders related to both internal and external traceability. It is recommended that the traceability team leader be the formally designated dairy risk management programme operator. It is also recommended that a member of the senior management team should be included or have close oversight. Roles and responsibilities must be clearly defined and may include, but are not limited to, the following examples in *Table 4*:

Person	Responsibility
Traceability Team Leader	Co-ordinate the development, implementation and verification of the traceability process
Quality and Food Safety Representative	Your subject-matter expert on organisational, regulatory and customer requirements for quality and food safety
Operational Representative	Your subject-matter expert for internal traceability
Procurement Representative	Your subject-matter expert for external traceability relating to ingredients, materials and supply
Supply and Logistics Representative	Your subject-matter expert for external traceability relating to participants outside the dairy facility where goods are transported, stored or supplied
Information Systems Representative	Your subject-matter expert on information and associated systems that contribute to the traceability data
Compliance Representative	Your subject-matter expert on legal and regulatory frameworks that apply to the sale of the dairy products

Table 5. Roles and responsibilities for traceability teams

3.4.4 Step 4. Outcomes of the traceability process

Outcomes of the traceability process need to be defined by the team with two perspectives in mind:

- Regulatory requirements (legislative, dairy RMP and Overseas Market Access - Requirements (OMARs)) -
- Business needs (ie reputational risk, customer needs, timeliness and accuracy)

In addition to the regulatory requirements, the traceability team needs to facilitate agreement to the acceptable business risk and granularity of data that will be available to manage traceability. The traceability team will need to identify what traceability requirements they must meet in the New Zealand context, including OMARs, but it is also recommended that they be aware of the international jurisdictional requirements under which their products are supplied.

3.4.5 Step 5. Map all events

Map the entire process from your suppliers to your customers (one-step backwards, one-step forwards). You will need to note each of the following:

- Movement
- Transformation
- Storage
- Usage: using (and recording) resources, facilities and equipment
- Destruction
- Dispatch

The outcome of this exercise will be a map of all events in your dairy facility operation.

3.4.6 Step 6. Establish boundaries of internal and external traceability

Establishing boundaries will help identify traceability participants, the criteria for traceability data design and roles and responsibilities of all participants.

3.4.7 Step 7. Identify the type of event

Please refer to page 13 of the document for a fuller description of the events to track, including movement, transformation, storage, usage and destruction. Note that not every event is necessarily a traceable event; determine at this point which events will need to be tracked or are critical to traceability. You will find the flow chart in *Figure 9* below useful in determining whether an event is definable as a CTE for traceability purposes.

3.4.7.1 What makes an event a CTE?

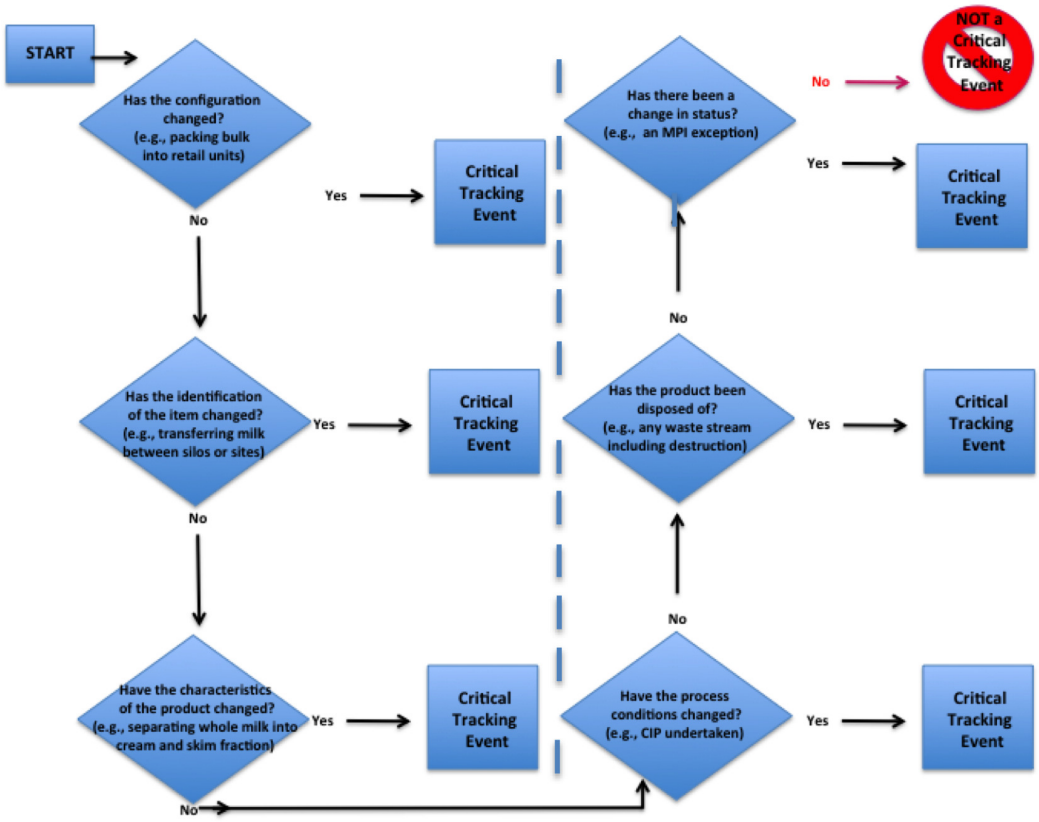


Figure 9. Flow chart to determine if an event is a CTE

3.4.7.2 Establish for each traceable event a CTE

The following specific areas are common in dairy facilities and should be considered when identifying your CTEs:

- **Aggregation including raw milk, whey and ingredients:** It is the responsibility of the dairy facility operator who aggregated the dairy product to keep the records of the lot identity. If aggregation occurs at a reloading station, the station must keep the associated records, as would any other dairy-processing facility
- **Rework:** Rework must be included in the traceability process. It must be treated as any other input or ingredient. New lot identification must be established at the point it becomes an output and this identification is used when the rework is an input. If the rework is a final product, use that lot identification. Rework might typically include, but is not limited to:
    - Fluid milk filler flushes saved for use in chocolate milk
    - Skim milk powder out of specification and reworked into the dryer
    - Cheese fines added back into the cheese
    - Ice cream from beginning of churn operation sent back to mix tank
    - Stop/start bins from a milk powder line

- **Packaging materials:** Any packaging materials that are in direct contact and/or primary labelling (including any labelling required that satisfies requirements for food safety at any level of packaging) for the product must be identified and the appropriate details (ie identification, batch, date of manufacture etc) recorded
- **Additional CTEs that need consideration:**
    - Addition of CO_2, or other gases
    - Use of bags and liners for product packaging in contact with food and the final packaging that provides product information (such as ingredients, allergen warning statements) to the consumer.
    - Vitamins and small-quantity additives
    - Disposed ingredients or products
    - Materials awaiting the results of grading
    - Customer samples
    - Test samples

Records should be maintained for ingredients, products and packaging materials that are disposed of. The quantity disposed of, and the lot identification should be recorded as it is with any final product.

3.4.7.3 Storage that does not get Cleaned in Place (CIP'd) on a frequent basis

Oils, sugars and other bulk ingredients are stored for long periods of time without the storage vessel being completely emptied or CIP'd. This is common and safe, but please recognise that this practice may weaken the power of your traceability system by lessening the granularity of tracing.

Several options exist to solve this. Choose the one that fits your product and the risk you have agreed in your RMP. Document your chosen method for each storage vessel in the physical model.

Two of the most common methods of dealing with long-term storage:

- Reset the trace for this vessel on a calculated first-in, first-out method. For example, 65,000 litres of oil were delivered, so the first 65,000 litres used exhausts that lot. On a recurring basis (possibly monthly), true up the calculated inventory to actual inventory
- Reset the trace based on a recurring time period. This is common practice for city water, since there is never really an interruption. For city water, many reset the trace every 24 hours

3.4.7.4 Continuous processes

Some processes run for longer periods of time than is practical for consideration as one lot of finished product. For example, spray dryers, powder silos or other processes may run for several days without stopping for a CIP. Irrespective of this continuous process, the flows through these processes need to be documented to provide good traceability.

An example solution is to create a CTE whenever a source or destination changes.

- On a dryer, create a CTE when the powder bin selection changes
- For an evaporator, create a CTE whenever the silo feeding the evaporator changes

- If these two examples are combined, the quantity of product under one CTE becomes much smaller, reducing the size of the lot that will be in scope for a trace request

3.4.7.5 Assign an event owner for each CTE

Determine if an owner is required and if so, agree an owner. Ideally, traceability processes create an owner for each CTE.

3.4.7.6 Lot identification rules for each CTE and a method to uniquely identify each lot

Best practice for lot identification is the use of global data standards ie a globally unique and recognised identifier for each lot. Any dairy material that moves between internal and external traceability parties must be identified through the use of global data standards. Please refer to page 16 for further details.

3.4.7.7 Develop the KDEs to associate with each CTE

KDEs are the data elements captured during a CTE that describe the who, what, when, and *where* of the CTE and must be collected for traceability. *Table 6* below provides an example of the five data elements that must be captured and recorded.

KDE	Example
Who = which participant	Milk tanker 100
Where = what location	Bay 3 at dairy factory
When = date/time	07.25, 12.09.2015
What = identifying the traceable item	(Milk)
What happened = identifying the process or event	(Into holding tank 4)

Table 6. Examples of key data elements

3.4.8 Step 8. Agree the protocols for data capture, storage and exchange

Every traceability participant has a responsibility to maintain agreed data that:

- Links an input to a CTE with the output
- Links the original and final location after transportation

This agreed data applies equally to your supplier and to your direct recipients (the one step up, one step down principle). Traceability participants also include MPI. Protocols are necessary to ensure traceability information is interoperable where feasible.

3.4.8.1 Master data and transactional data

Agree with your traceability participants what master and transactional data should be exchanged. Remember that master data is relatively consistent over time and independent from day-to-day events. Transactional data describes time-bound events (usually relevant regarding lots, or in transportation). Please see page 18 for more detail.

3.4.8.2 Data representation

Agree with your participants what data – and particularly, your unique lot/product identification – will be recognised. A standardised approach to how the data is labelled and displayed is best practice, as is having both machine-readable and human-readable data. Consideration needs to be given to maintaining indelible and visible traceability identification on all layers of packaging (including shrink wraps etc).

In most cases, it is best practice that all traceability participants mimic the product information data provided by their supplier to allow a holistic view of the supply chain (see master data, page 18). In other words, product and information will flow from source to recipient, and subsequently, the recipient can provide the same information provided by the source when in turn, they ship on the product, either as a further processed item or in its originally received form. The more visible the products moving along the supply chain, the more accurate the information that can be acted upon in your traceability processes.

Using machine-readable technologies such as bar code scanning or RFID enables data to be captured, stored and retrieved without the need to visually review the human-readable information and manually key that information into systems. As such, it can improve data accuracy by reducing or eliminating errors. The accuracy and efficiency gained by machine-readable data make it a preferred method to manual entry.

3.4.8.3 Data exchange

Agree with your partners how traceability data will be shared. All participant-agreed traceable information should be captured and stored within a traceability system. The best practice for data sharing is electronically. Use of data standards such as GS1 XML and EANCOM provide a standardised and predictable structure for electronic business messages, enabling traceability partners to communicate data rapidly, efficiently and accurately, irrespective of their internal hardware or software types.

As it is required that the data be made available electronically in a format editable by standard commercial software (ie machine-readable)[13] to the relevant competent authorities such as MPI, electronic capture and storage are recommended.

3.4.8.4 Data storage

Data must be stored for a minimum of four years.

3.4.8.5 Ensure cross border contracts also include interoperability of traceability data

It is anticipated that, globally, full-chain traceability will increasingly become expected. New Zealand dairy exporters should therefore ensure that provision for tracking and tracing product at least 'one-up, one-down' is included in their contracts with offshore partners and logistics providers. This will establish an information interface supporting traceability beyond New Zealand's borders.

3.4.8.6 Best practices for labelling cartons for external traceability

The minimum requirements for carton-level traceability call for a combination of the globally unique identifier such as a GTIN and Batch/Lot or Serial Number. Best-practice information used to ensure traceability includes:

- Provider/manufacturer/brand owner identification
- Origin or location information
- Purchase order number or packing slip of received product
- Date of shipment and receipt
- Carrier name and registration number or other identification of the truck or trailer

[13] In a form that a computer can accept. Machine-readable data is data that can be transmitted and received electronically, or data that comes from a device connected to a computer or other electronic device.

- Item identification and piece count for each product
- Lot identification for each carton -

An example of a carton label is provided in *Figure 10* below. -

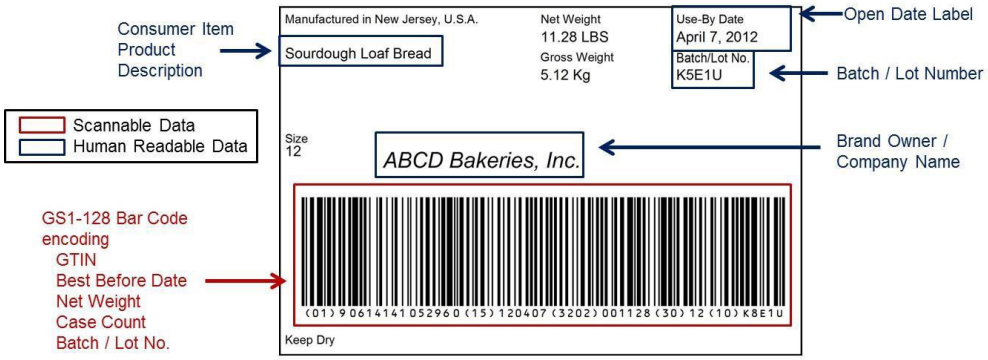


Figure 10. Carton label

Electronically capturing the traceability information of the carton and associating that information with all movements of that product throughout the supply chain achieve the best practice for carton-level traceability. This is best achieved through bar code or RFID scanning and then the use of an electronically transmitted Advance Ship Notice (ASN).

The supplier must assign carton serial numbers, if used, to each carton at the time of packing. Best practice is that Serial Shipping Container Code (SSCC) [14] serial numbers be generated (eg a simple sequential number without any production facility or production date and time reference). However, it is important to link the range of serial numbers assigned to a lot number, production facility, production date and time, etc, for reference with regard to any queries about the carton.

3.4.8.7 Best practices for pallet traceability

Once cartons have been picked and placed on a pallet, the best practice is to assign a globally unique identifier to each pallet, such as a SSCC. A SSCC can be assigned to any logistics unit, including a pallet (refer page 14). The unique shipping container identification is typically part of a larger label affixed to the pallet. An example of a pallet label is provided in *Figure 11* below.

[14] Additional information regarding the use of SSCCs can be found at: http://www.gs1.org/resources/standards/sscc

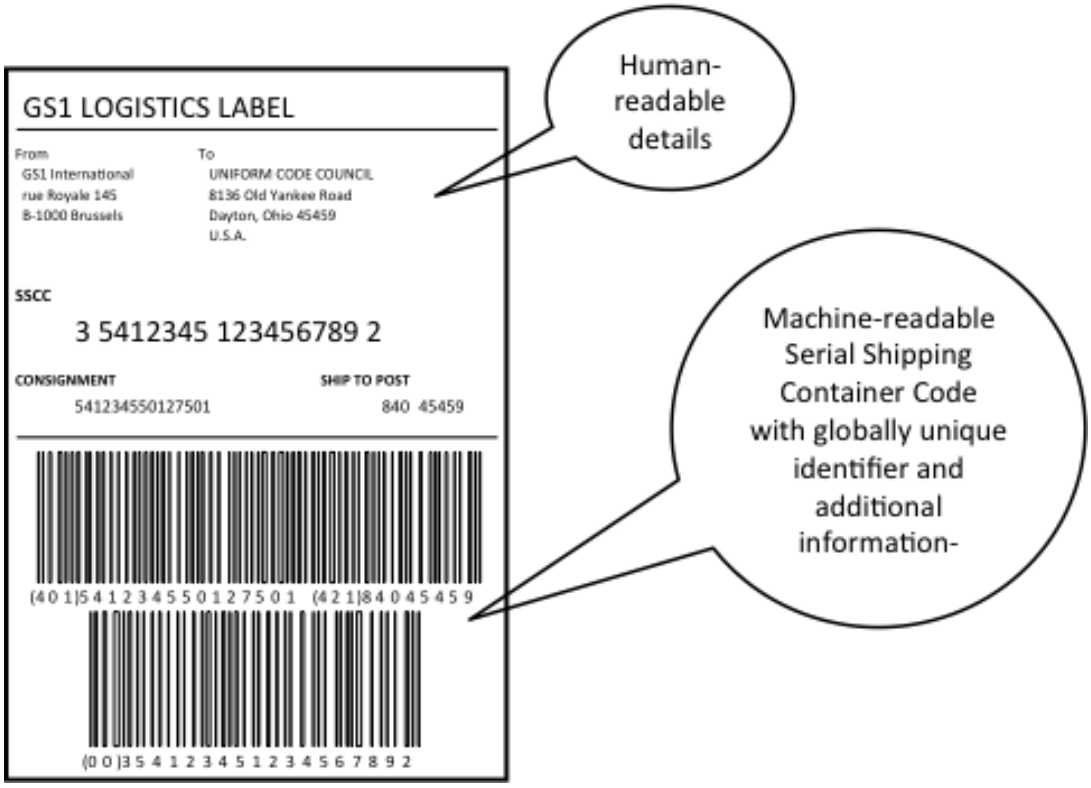


Figure 11. Example of a pallet label

Additional information may be shown on the label, (see above examples in "carton best-practice information used to ensure traceability") depending on the requirements of the jurisdiction and trading participant. Most often, the additional human-readable information includes the shipper name and address, carrier and delivery information.

When using a logistic unit's globally unique identifier (the SSCC), this identification exists only for the duration of the shipment between trading parties. As shipments are broken down upon arrival, it is not intended to be considered a primary identifier for product traceability. However, it can provide some links when contents are related to the larger shipment identifier. Unique shipment identification information may be used as a reference, along with other document identification such as bills of lading, manifests, advance shipping notices etc.

3.4.8.8 Bills of lading, manifests and advance ship notices

The bill of lading is the legal document summarising information about the goods being transported. The manifest document describes individual order details such as product identification, individual case weights, etc. Advance Ship Notices (ASNs) are electronic messages created by the shipper and sent to the recipient using Electronic Data Interchange (EDI). They are used to communicate similar transportation information as the bill of lading and manifest. The traceability data elements required for ASNs are the same for all dairy products, including fixed-measure and variable-measure items, as well as refrigerated and shelf-stable products. Best practices require the following data elements to be included in the paper-based manifest and/or the electronic ASN:

- Globally unique product identification (eg a GTIN)

- Batch/lot or serial numbers
- Quantity shipped
- Shipping and receiving dates
- Ship from and destination locations

In addition, the following information may be included as appropriate for your records:

- The product identifier, or other supplier or customer product identification reference, often referred to as a SKU (Stock-keeping Unit)
- The best before or expiry date

3.4.8.9 External supply chain CTEs and KDEs

The following table identifies some of the common CTEs and the corresponding Key Data Elements (KDEs) in external traceability:

External Critical Tracking Event (CTEs)	Examples	Key Data Elements (KDEs)
Product packing and repacking	Product enters the supply chain Aggregation of discrete packs or cartons or pallets Disaggregation / breakdown of packs, cartons and pallets Conversion (repacking, relabeling)	All KDEs must answer the same questions: **What** = globally unique product identification, Lot # or logistics unit identification **When** = date and time of the CTE **Where** = location identification ie name of the manufacturer or brand owner **What happened (why) =** description of the CTE
Product receipt	Order unloading and storage or put away activities, segregation, quarantine, etc	
Product shipping	Order preparation activities, picking, staging, loading etc	
Product disposal	Transportation accidents, procedural errors, equipment failure, product recalls, withdrawal and disposition etc	

Table 7. Common CTEs and KDEs in external traceability

3.4.9 Step 9. Agree with stakeholders how the traceability system will be verified and tested

As part of an RMP, an RMP operator must have a documented inventory-control procedure that includes trace back and track forward. The verification requirements will be audited at a frequency determined by an RMP verifier recognised by MPI. This audit would be at least annually, but could be more frequent depending upon the previous levels of compliance of the RMP operator.

The dairy facility should also ensure practical tests of traceability processes are independently verified annually where a product recall has not taken place within the last 12 months. This could, for example, include tracking forward all the CTEs of a given lot of dairy product; and/or tracing back from an export certificate all CTEs. The data produced will need to be accessible and be made available electronically in a machine-readable format editable by standard commercial software to regulators and verifiers within their given timeframe. For testing purposes the timeframe is 24 hours, but situations may vary, and best practice requires that information be made available to

the trace requester as quickly as possible. The time frame may be as short as 2-4 hours in serious circumstances.

3.4.10 Step 10. Implementation of the traceability processes

Implementation of the process is the final and most crucial step. You must ensure documentation, validation, records management and training etc is developed. Documentation for all stages of the traceability process must be completed. Examples of documentation include examples of rationale for lot size, CTE determination and a list of critical event owners.

Records required by MPI will need to be stored and maintained for the greater of either four years or one year past the shelf life of the dairy product.

Records[15] include:

- The supplier of the dairy material, dairy product, ingredients and packaging
- Identification of parties (name and location, New Zealand Business Number, - etc) -
- Product ID
- Lot number/batch number of the dairy material, dairy product, ingredients - and packaging -
- Product type of dairy material, dairy product, ingredients and packaging.
- Date
- Location
- Serialisation data if the product is serialised

A staff-training programme on traceability should be established. This should include traceability awareness training for senior management (as appropriate), managers, supervisors, technical staff and process staff. Specific traceability training will be required for key personnel. Note all these aspects will need to be independently verified.

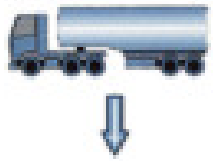
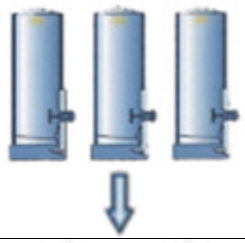
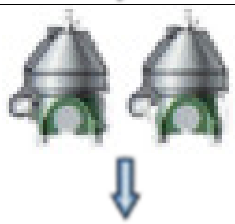
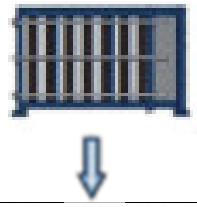
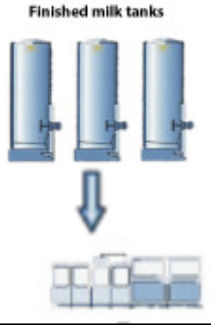
3.5 ILLUSTRATIVE EXAMPLES

The following pages are examples of simple manufacturing processes common in the dairy industry. In each example, we identify the places in the process where a new CTE and KDE will need to be recorded.

3.5.1 Town Milk and Cream Manufacture

Scope: The collection of whole milk, processing and packing skim milk into retail ready units including the load out of processed cream as a waste stream.

[15] Details provided here are from the proposed regulatory requirements for traceability, and will need to be reviewed once consultation has been completed.

Process	Critical Tracking Event (CTE)	Key Data Element (KDE)
	Collection and transportation of raw whole milk from farm silo	Farm(s) identification Driver Name Tanker and trailer identification Date and time of collection from each farm Volume of milk picked up per farm *Note: Samples taken will have their own CTE*
	Storage of pooled raw whole milk	Silo identification number Date and time Internally unique identification and lot number Event owner Raw pooled milk in silo
	Separation of cream and skim fractions	Silo identification number Separator Number Internally unique identification and lot number Date and time Event owner Cream and skim fractions
	Pasteurisation and chilling of cream and skim fractions	Separator Number Pasteuriser Number Internally unique identification and lot number Date and time Event owner Pasteurised cream and skim
	Pasteurised milk and cream storage	Pasteuriser Number Silo Number Internally unique identification and lot number Date and time Event owner Pasteurised cream and skim to silo
	Cream load out to another facility	Silo number Tanker and trailer identification Globally unique external identification & lot number Date Time Event owner Pasteurised cream transferred to tanker
	Pasteurised skim milk to packing line	Silo number Packing Line Number Internally unique identification & lot number Date Time Event owner Packing material identification (bottle, induction seal, cap, label) Skim milk packed

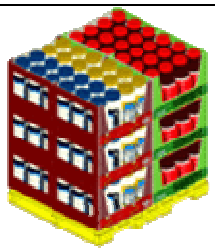
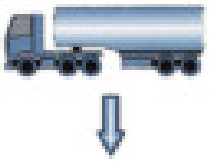
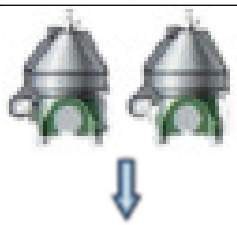
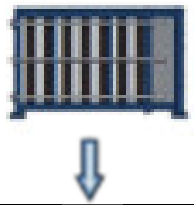
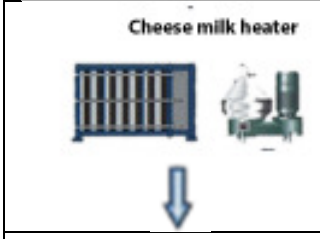
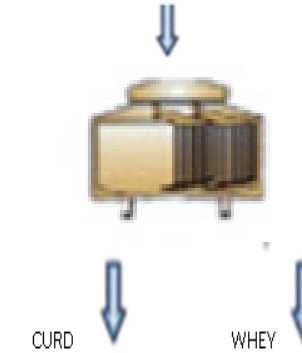
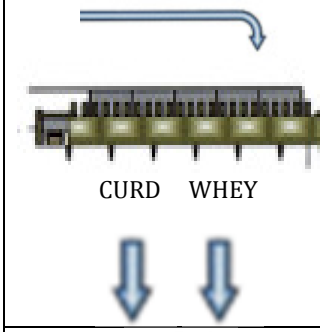
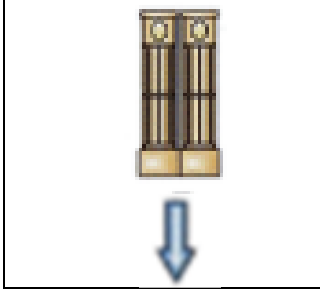
Process	Critical Tracking Event (CTE)	Key Data Element (KDE)
	Bottles of milk assembled onto pallets	Packing line number Internally unique identification & lot number Date Time Event owner Globally unique external identification for each pallet Skim milk palletised

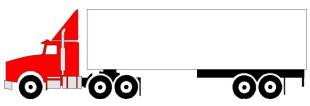
Table 8. Town milk and cream manufacture

3.5.2 Cheddar cheese manufacture

Scope: The collection of whole milk, processing of milk to manufacture dry salted cheddar blocks including the load out of whey as a waste stream. It is assumed that rapid chill and maturing are done within the same dairy facility.

Process	Critical Tracking Event (CTE)	Key Data Element (KDE)
	Collection and transportation of raw whole milk from farm silo	Farm(s) identification Driver Name Tanker and trailer identification Date and time of collection from each farm Volume of milk picked up per farm *Note: Samples taken will have their own CTE*
	Storage of pooled raw whole milk	Silo identification number Date and time Internally unique identification and lot number Even owner Raw pooled milk in silo
	Standardising of cheese milk	Silo identification number Separator Number Internally unique identification and lot number Date and time Event owner Cream and skim fractions
	Pasteurisation and chilling of cheese milk	Separator Number Pasteuriser Number Internally unique identification and lot number Date and time Event owner Pasteurised cheese milk

Process	Critical Tracking Event (CTE)	Key Data Element (KDE)
	Storage of cheese milk	Pasteuriser Number Silo/Vat Number Internally unique identification and lot number Date and time Event owner Pasteurised cheese milk
	Heating of cheese milk for starter addition	Silo/Vat Number Heat exchanger number Internally unique identification and lot number Date and time Event owner Pasteurised cheese milk
Rennet & Starter Culture 	Addition of rennet and starter to pre-heated cheese milk	Heat exchanger number Cheese – O – Vat Number Internally unique identification and lot number Date and time Event owner Rennet and Starter lot numbers Curd to cheddaring belt Whey to collection vat
SALT 	Cheddaring belt	Cheese – O – Vat Number Internally unique identification and lot number Date and time Event owner Salt lot number Curd to towers Whey to collection vat
	Curd Filling Tower	Cheddaring belt number Curd tower number Internally unique identification and lot number Date and time Event owner Packaging lot number

Process	Critical Tracking Event (CTE)	Key Data Element (KDE)
	Block forming and wrapping	Curd Tower Number Block forming station Internally unique identification and lot number Date and time Event owner Packaging lot number Blocks of cheddar to rapid chiller
	Rapid Chilling	Block former station number Rapid chiller number Internally unique identification and lot number Date and time Event owner
	Maturing cheddar blocks	Rapid chiller number Maturing room number Internally unique identification and lot number Date and time Event owner *Note: any movement of product to location outside the boundary of the dairy facility will require globally unique identification and lot number*
	Palletising Blocks	Maturing room number Palletiser Number Internally unique identification and lot number Date and time Event owner *Note: any movement of product to location outside the boundary of the dairy facility will require globally unique identification and lot number*
	Transport of blocks for further processing (cutting/wrapping & grating/bagging)	Palletiser Number Truck Number Serial shipping container code (SSCC) Globally unique identification and lot number Date and time Event owner Palletised blocks for further processing

Process	Critical Tracking Event (CTE)	Key Data Element (KDE)
	Whey collection from O-Vat and mellowing belt.	Cheese O-Vat Number Whey Collection Tank Number Internally unique identification and lot number Date and time Event owner Whey out load
	Load out of collected whey into tanker to be transported to another site for further processing	Whey Collection Tank Number Truck & Trailer number Globally unique identification and lot number Date and time Event owner Whey for further processing

Table 9. Cheddar cheese manufacture

4 APPENDICIES

4.1 LIMITING RISK BY PROCESSING METHODOLOGIES

The scope of a potential request for trace can be significantly reduced by how your facility chooses to conduct processing. For example, in the United States, many dairy facilities[16] analyse how they are using their equipment and are adopting practices that limit potential contamination by 50-75 per cent. Traceability scope that was once thought to be broad has been found to be quite easy to narrow.

The aggregation of products can be significantly reduced by creating and enforcing policies with plant floor staff about the use of tanks and silos and when to CIP them. The suggestions that follow are common in dairy-processing facilities; however, it is the principles below that are worth considering:

4.1.1 Receiving storage

- Reduce the silos that one truck of farm milk is able to receive into. For instance, one manufacturer found operators were "topping off" multiple silos when the silos were nearly full. The real issue was that another crew did the silo CIPs and this was tying up storage space. After review, CIPs on these silos were done expeditiously and receiving operators were coached to limit one truck to be split to only two silos.
- Perform CIP on a silo or tank when it is emptied, before returning it to use, even if the silo is still under the CIP requirement. Determine what constitutes a clean reset on the silo or tank, and perform this when it is empty, before returning it to use.
- Eliminate, except in cases of absolute necessity, receiving into a silo or tank and drawing out of it at the same time. This can almost always be eliminated and allows for much cleaner traceability.

4.1.2 Processing

- By switching between two feed tanks between the evaporator and the dryer, you can lot identify each lot of your powder by the feed tank that was delivering at that time. While trace amounts could be co-mingled, it still reduces the non-diluted powder to be identified.
- Switch powder bins at the same time as dryer feed tanks. While there will be traces of powder co-mingled across bin changes, this reduces the non-diluted powder to recall. Typically non-diluted powder will be the only powder identified to be traced if the practices are good.
- Record when a powder bin has been emptied. This will be evidence that the bin could only have trace amounts of a contaminant.
- In your batching tanks, perform some type of CIP to remove the residue of one batch from another. CIP when a product type is changed, even if there are no conflicting ingredients.
- Create a new lot identification whenever the source or destination of the pasteuriser or separator changes. A routing change creates a good break for product history.

[16] Innovation Centre for US Dairy: "Guidance for Dairy Product Enhanced Traceability", 2013. See http://www.usdairy.com/premium-content?url=%252f%257e%252fmedia%252fusd%252fprivate%252fguidancefordairyproductenhancedtraceability.pdf.pdf

4.2 GLOBAL DATA STANDARDS

Experience in multiple sectors[17] has demonstrated that *".... global standards adoption is not a zero-sum game: benefits could be shared across the value chain."*

Global data standards allow businesses to identify, capture, edit, share and exchange diverse data. In order for data to flow freely and efficiently there is a need to establish, store, reuse and share precise core component and business definitions and their equivalent representations. These are standards that a community of users agrees to (or that are required/mandatory in some fashion) so that the community of users can communicate.

There are many different elements of global data standards:

- Identification (unique identifiers, recognition)
- Data capture (bar codes, RFID)
- Code sets (code values, decode descriptive text)
- Valid values (allowable data values)
- Structures (rules, sequence, composition)
- Data dictionaries/vocabularies (XML, EDI)
- Formats (sequences of patterns, characters etc)

According to the many standards organisations, an open global data standard (GDS) fulfils the following conditions:

- Widely accepted and used globally (or at a minimum, regionally – say EU, APEC)
- Interoperable
- Collaborative/consensus-based development and/or approval
- Transparent standards development process
- Inclusive and industry sector agnostic
- Reasonable and Non-Discriminatory Terms (RAND) Intellectual Property Rights policies
- A standard is published and made available to the general public under reasonable terms (usually free, eg GS1 does not charge. Sometimes standards are made available for 'a reasonable fee' – New Zealand Standards Organisation and Dun and Bradstreet charge for the access and/or use of their standards)

[17] http://www.mckinsey.com/search.aspx?q=strength+in+unity%3A+the+promise+of+global+standards+in+health

4.3 GLOSSARY

APEC	Asia Pacific Economic Cooperation. A regional forum for 21 Pacific Rim member economies that seeks to promote free trade and economic cooperation throughout the Asia-Pacific region.
Advance Ship Notice	An electronic data file sent from a shipper to a receiver (prior to receipt) that contains information about a delivery.
Aggregation	The action of collecting of inputs or ingredients together. This is a critical tracking event in traceability.
Batch	An homogenous quantity of material with the same characteristics.
Bill of lading	A legal document between the shipper of a particular good and the carrier detailing the type, quantity and destination of the good being carried. The bill of lading also serves as a receipt of shipment when the good is delivered to the predetermined destination. This document must accompany the shipped goods, no matter the form of transportation, and must be signed by an authorised representative from the carrier, shipper and receiver.
Brand owner	The party that is responsible for allocating traceability identification.
Clean in Place (CIP)	Refers to cleaning the interior of dairy-processing equipment (such as milk silos) without requiring disassembly.
Co-mingling	The action of mixing inputs or ingredients together. See *Aggregation.*
Critical Tracking Event (CTE)	Critical tracking events are those events that must be recorded in order to allow for effective traceability of products in the supply chain. This includes those instances where product is accumulated, moved between premises, is transformed, or is otherwise determined to be a point where data capture is necessary to trace a product.
Dairy material	Animal material that is (i) milk extracted from a milking animal, and (ii) any material derived or processed from milk extracted from a milking animal, up until delivery of the material at the place of sale for consumption or for end use for purposes other than consumption, or its export; and also includes dairy product that, having been purchased or imported, is further processed.
Dairy product	Animal product that, having originally been dairy material, has been (i) delivered to the place of sale for consumption, or for end use for purposes other than consumption; or (ii) has left New Zealand's territorial waters in the course of its export.
DataBar	A product identification symbol, similar to a barcode, that can be scanned at retail point- of-sale (POS), and can carry additional information such as serial numbers, lot numbers or expiry dates.
Downstream traceability	The ability to track forwards the movement of a product. It makes it possible to find the destination of a lot or product unit at every step of the product's life cycle.
Electronic Data Interchange (EDI)	The computer-to-computer exchange of structured information, by agreed message standards, from one computer application to another by electronic means and with a minimum of human intervention.
Event	An occurrence of a process in a specific time or a period of time.
External traceability	External traceability takes place when instances of a traceable item are physically handed over from one traceability participant to another.
HACCP	The Hazard Analysis and Critical Control Point system adopted by the Codex Alimentarius Commission. HACCP is a systematic identification of hazards and the measures for their control to ensure the safety of food. It focuses on prevention rather than end-product testing.

Human- readable data	Characters that can be read by humans, such as letters and numbers, as opposed to symbol characters within bar codes, which are read by machines.
Global Open Data Standard (GDS)	Global open data standards arise after discussion on the technical and economic merits, demerits and feasibility of a proposed common protocol. It is published and is available freely or at a nominal cost, with no further encumbrances. Various vendors and individuals can use the standards to make products that implement the common protocol defined in the standard, and are thus interoperable by design**,** with no specific liability or advantage for any customer for choosing one product over another on the basis of standardised features.
GTIN	Global Trade Item Number. A GTIN is a globally unique product identification number.
Internal traceability	Internal traceability takes place when a trading participant receives and records instances of traceable items as inputs that are subjected to internal processes.
Interoperability	The ability to communicate master (and transactional?) data in a standardised and transparent way with all traceability participants .
Key Data Elements (KDEs)	The data captured during a Critical Tracking Event to support a successful traceability process.
Logistic unit	An item of any composition established for transport and/or storage that needs to be managed through the supply chain.
Lot	A quantity of material produced under consistent process conditions.
Master data	Master data describes each item and party involved in supply-chain processes and is defined as data having the following characteristics: • Permanent or lasting nature • Relatively static, not being subject to frequent change • Accessed/used by multiple business processes and system applications • Can either be neutral or relationship-dependent.
OMARs	Overseas Market Access Requirements. Countries and markets that have agreements with the New Zealand Ministry for Primary Industries for food products entering their borders.
Party	A party (or) location is any legal, functional or physical entity involved at any point in any supply chain and upon which there is a need to retrieve pre-defined information.
Process	A series of actions or steps towards achieving a particular end. Examples of common processes include Production, Transformation, Quality Control, Storage, Transportation, Movement, Recycle, Return, Packing, Receiving, Disposal and Traceability.
RFID	Radio Frequency Identification. Wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. RFID tags contain electronically stored information.
RMP	A documented Risk Management Programme (RMP) is a written programme under the Animal Products Act 1999 designed for each facility to identify; control, manage, and eliminate or minimise the hazards and other risk factors in relation to the production and associated with processing of dairy material and products in order to ensure. It ensures that the resulting dairy product is products are fit for their intended purpose and meet the appropriate New Zealand animal product standards. An RMP needs to be verified annually. To be eligible for official assurances (export certificates), RMPs must be registered with MPI in accordance

	with the Animal Products Act 1999.
RMP operator	A Risk Management Programme (RMP) operator is a person currently recognised or accredited under section 103 of the Animal Products Act 1999 as a risk management programme owner as an RMP verifier.
Serialised identification	This method of identifying unique items at the unit or retail level as well as at the case and carton levels is composed of a globally unique identification for the product and an individual serial number.
Serial Shipping Container Code	The serial shipping container code (SSCC) is an 18-digit number used to identify logistics units. In order to automate the reading process, the SSCC is often encoded in a barcode, generally GS1-128, and can also be encoded in an RFID tag.
Interoperability	Ability to make systems and organisations work together (inter-operate).
Shipment	An item or group of items delivered to one party's location at one moment in time that have undergone the same dispatch and receipt processes.
Recall	A food recall attempts to remove food from distribution, sale and consumption in order to protect consumers from harm where product is not fit for purpose.
Stock Keeping Unit (SKU)	An internal number or code used to identify a product within a company. It may be unique within a company, but NOT globally unique and not recommended for traceability.
Traceability	Traceability is the ability to track forward the movement through specified stage(s) of the extended supply chain and trace back the history, application or location of that which is under consideration.
Traceability data	Any information about the history, application or location of a traceable item. This may be either master data or transactional data.
Traceability , participant	Any supply-chain partner that has a direct impact on the flow of goods through the supply chain. Examples include third-party logistics provider, manufacturer, retailers, wholesalers, distributors, or dairy facility operators.
Traceable item	A physical object where there may be a need to retrieve information about its history, application or location. Could be tracked, traced, recalled or withdrawn. Could exist in multiple locations at the same time (eg if identified at the trade item and batch level). A traceable item may be related to another traceable item.
Trace request	A formal inquiry about the history, application or location of a traceable item. A request can trigger subsequent trace requests up or down the supply chain in order to fulfil the original request.
Tracing back	The ability to identify the origin attributes, or history of a particular traceable item located within the supply chain by reference to records held.
Tracking forward	The ability to follow the path of a traceable item through the supply chain as it moves between traceability participants.
Trade item	Any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain.
Transformation	A change to the nature of a traceable item that changes the identity and/or the characteristics of the traceable item. The act of changing the item such as combining ingredients to make a finished product or case picking to create a new pallet. Transformation can include combining or blending ingredients, pasteurisation, brining, drying etc.
Transporter	The party that handles and or stores the traceable item from one point to another without transforming the item. That party can receive, carry and deliver one or more traceable items. The transporter may only have

	"possession, custody, control" of a traceable item, as distinct from ownership.
Unique identifier	A numeric string of numbers that is not replicated anywhere else in the world and used to uniquely establish the identity of a physical object.
Upstream traceability	The traceability of raw materials involved in the production of a product. This makes it possible to find the production and packaging history and the origin of a lot at every step of the raw materials' life cycle.