

## From Farm to Fork: Safe Food Transport and Storage

Food processing | Why do we process food? | 12 October 2009

Those working with food during transport and storage observe operating and monitoring procedures which are critical to food safety.

### Complex chain

The food chain consists of a series of steps, beginning with planting and growing through to harvesting, initial and final processing and, finally, sale to the consumer. At each step along this complex chain, quality is maintained by trained professionals. In addition, great care is also taken in the important intermediary stages of transport and storage where food must be protected against a multitude of potential hazards such as:

- Cross-contamination between live animals being transported together
- Cereals becoming mouldy or infested with insects if not transported and stored in clean containers
- Eggs, normally transported without refrigeration, being contaminated with *Salmonella enteritidis* if transport is prolonged over two weeks: at elevated temperatures during transport, the *Salmonella enteritidis* can propagate. The World Health Organisation (WHO) now recommends that eggs be cooled and transported in refrigerated containers
- Soft cheese, which is prone to *Listeria*, becomes a problem if not transported and stored at proper temperatures.

Maintaining the quality and safety of food in transport and storage requires both: 1) operating procedures to ensure the preservation of food products and 2) monitoring procedures to ensure operations are carried out as intended.

### Monitoring

Identity documents are essential elements in monitoring transport and storage procedures. They trace a food product's history from the farmer's field or barn right through to the consumer's plate.

To ensure this "traceability" of food products, all participants in the food chain commit themselves to documenting each step in the process. The history of a product contains a great number of important details: the land on which the product was raised, the lots of seed and fertiliser used, the record of pesticide treatments where appropriate, dates of harvesting, location of storage silos, the particular herd or flock from which an animal came, the date and location of slaughter, location and date of processing and packaging, the identity of ingredients used in processing, the condition of transport vehicles, the dates, duration and conditions of transport, storage locations, dates by which the product should be used and why, the name and location of the final retail store.

The methodical recording of this data is in part due to the increased awareness of its importance by the participants in the food chain and also to the use of modern information technology to process the relevant information.

## Proof of proper procedures

Monitoring and assembling documented product histories is only valid if it is possible to measure specific parameters at every stage of the chain. These must attest that all the conditions necessary to ensure quality have been met. Temperature, humidity, atmosphere, length and conditions of handling are all critical. The most effective way to illustrate their importance is to show how they apply to a product such as milk. How should milk be transported and stored

## Temperature

The temperature of milk fresh from the cow is around 37°C. When cooled to 4°C, it can be stored in tanks for up to 48 hours. This temperature is maintained during collection and transportation to the processing plant in insulated tanks, right up to the actual processing into milk or cheese products.

Maintaining low temperatures is indispensable to transporting milk both prior to and after processing. Any delay in transport diminishes the shelf life of final consumer products. In the retail outlets, liquid milk products (unless sterilised) are maintained at low temperatures both in storage and in consumer displays. To ensure proper procedures are carried out, temperatures are constantly monitored by thermometers on storage and transport tanks for raw milk, as well as thermometers and temperature-recording devices on delivery trucks, and at retail storage and sales locations.

Milk and milk products are just one example of the need for careful temperature control. Similarly, a wide variety of fresh products (vegetables, fish, meat, poultry, prepared meals) must be kept at low temperatures throughout processing, transport, storage and final sale.

Likewise, it is necessary to keep frozen foods at temperatures that prevent thawing before the product reaches the consumer. Temperature controls are obvious to the consumer in a retail store, but equally important are the controls in place during transport, including various types of passive insulation and active refrigeration units in trucks, rail cars and containers used for marine and land transport. Chocolate, for obvious reasons, should not be transported in non-insulated trucks on hot summer days; nor should mineral water travel in non-insulated rail cars in sub-freezing winter temperatures. It is imperative that food heated in advance be kept hot between locations, for example between a central institutional kitchen and the point of eventual consumption on an aeroplane or train, for example. All transport and storage containers along the route must be thoroughly insulated.

## Humidity

Air that is too dry or too damp damages many fresh foods. Excess humidity can lead to the growth of

moulds and bacteria on meat, and fungus on fruit, vegetables and dry cereals. Excessive dryness can dehydrate meats as well as some fruits and vegetables. Controlling humidity is often a question of how air is circulated around products in trucks, shipping containers and storage areas. In turn, air flow is dependent on the type of containers in which food is packed (net bags for certain kinds of vegetables, slatted cartons for certain fruits), and the way these containers are packed together, e.g., with relatively little air flow among them or with spacers between cartons specifically designed to enhance air flow.

## Atmosphere

Special atmospheric conditions are used less than temperature control for food preservation, but in certain cases, atmosphere control has a major impact on the quality of products in storage and transport. The best example is fruit that can now be picked in summer or autumn and preserved in special atmospheres for six months or more. A consumer may believe such long-term storage is only possible with chemicals; in fact, it is simply a matter of evacuating normal air from the storage facility and replacing it with "reconstituted" air which is low in oxygen and high in both nitrogen and carbon dioxide.

## Handling conditions

Workers handling food products throughout transport and storage play a critical role in food quality and safety. For this reason, training of personnel at each step in the process is important. They are responsible for ensuring products and packaging are neither physically bruised, broken nor bent.

Products must be kept free of dust, moisture, unsuitable temperatures, odours and various rodents and insect pests, all of which are capable of damaging the quality of the product. For example, products stored on damp, mouldy pallets could become mouldy themselves. Ham transported in a truck previously used for fish and not thoroughly cleaned could absorb fish odours. Biscuits made with flour transported in trucks used previously to transport polyethylene could become contaminated, making the products unfit for human consumption.

## Maintaining quality standards

Because of the importance of maintaining high standards in transport, an increasing number of agreements exist between organisations representing the food industry, transporters and even those specifically responsible for cleaning trucks and containers. In addition, there are at least three international bodies responsible for implementing quality standards in the transport and storage of food.

- The European Union's legislation on the preservation of hygiene and safety of food applies to transport and storage.
- The norms of the International Standards Organisation (ISO) contain a chapter on the storage and delivery of food products.
- The Codex Alimentarius established in 1962 by the World Health Organisation and the Food and Agriculture Organisation includes the issues of transport and storage in the overall



recommendations for the preservation of food.

Transport and storage form vital links in the food chain between the farmer's field and the consumer's table. While the role of the farmer, the food processor and the retailer in the food chain is easily understood, it is simple to forget the importance of well-managed transport and storage.

These links in the chain can make all the difference in ensuring the quality and health quotient of the food. Similarly, the professionalism of personnel in transport and storage, as well as the effectiveness of their procedures and tracking systems, play important roles in determining the quality of the food reaching the consumer's table.