CFCFA Logistics Management Training

Cold Chain Logistics

Definition of Cold Chain

The **cold chain** refers to the transportation of temperature sensitive products along a supply chain through thermal and refrigerated packaging methods and the logistical planning to protect the integrity of these shipments.

Key Elements of Cold Chain

- **Product**. A product is characterized by physical attributes requiring specific temperature and humidity conditions (e.g. perishability, fragility)
- **Origin / Destination**. The respective locations where a temperature-sensitive product is produced and consumed. It is indicative of the potential difficulty of making a product available at a market.
- **Distribution**. The methods and infrastructures available to transport a product in a temperature-controlled environment.

Design Target of Cold Chains

- Safety & security are critical
- Integrity & trust of supply chain
- Clear chain of control
- Traceability of product movement
- Tamper proof packaging
- Temperature monitoring device in product and in transport vehicle

Relations Fundamental in Cold Chain Operations

- **Conditional demand**. The demand of a product at a market (or place of consumption) is conditional to its qualitative attributes.
- **Load integrity**. Relates to the load conditions that must be provided to insure that a product keeps its value during transport. It can include adequate packaging and packing, as well as the conditioning that the product must go through before transport (e.g. fruit washed and cooled down).
- **Transport integrity**. The temperature controlled environment remains constant during transport, at the terminals and at the distribution centers involved in the transport chain

Achieve Temperature Controlled Environments

- Different products require different temperature level maintenance to ensure their integrity throughout the travel process. For instance, the most common temperatures are "banana" (13 °C), "chill" (2 °C), "frozen" (-18 °C) and "deep frozen" (-29 °C).
- Proper temperature control depends on:
  - Temperature of product at origin
  - Desire temperature range
  - Duration of transit
  - Size of the shipment
  - Packaging
  - Ambient or outside temperatures

Means of Controlling Temperature

- Power source required
  - Mechanical refrigeration (e.g. Thermo King, Carrier) is used in 50% of all the refrigerated cargo transported in the world
  - Heater
  - Smudge pot
- Power source not required
  - Dry ice
  - Wet ice
  - Gel packs
  - Eutectic plates
  - Liquid nitrogen
  - Quilts

Organization of Cold Chains

- **Shipment preparation**. Cold chain devices are commonly designed to keep temperature constant, not to bring shipment to desire temperature
- **Modal choice**. Based on distance between origin and destination, size and weight of the shipment, exterior temperature environment and time sensitivity
- **The "Last Mile"**. Must match receiving requirements & final transfer of shipment into storage facilities
- **Integrity and quality assurance**. Share data from temperature recording devices & smart seals
- **Custom procedures**. Must be familiar with Customs procedures to avoid delays

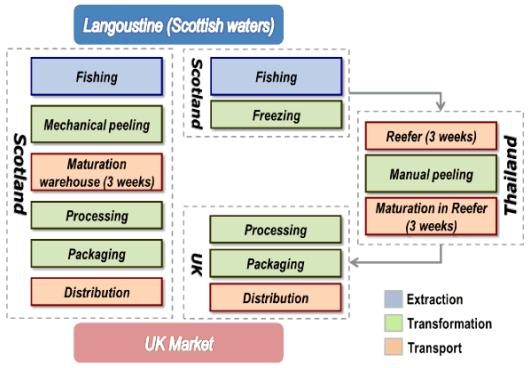
Cold Chain Products

- Food – fruits, vegetable, meat, prepared food
- Beverages – wine, beer, juice, bottled water
- Pharmaceuticals – bio-engineered drugs, antibiotics, experimental drug compounds
- Medical products - IV solutions
- Specialty chemicals
- Water based paint & adhesives
- Human organs

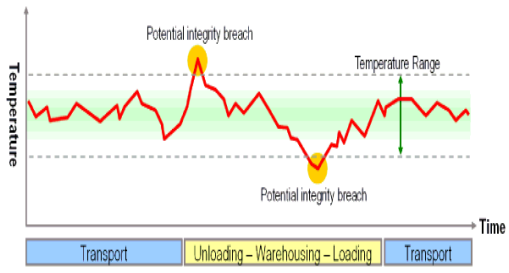
Food Transportation

- Innovations in packaging, fruit and vegetable coatings & controlled ripening reduce deterioration and extend the reach of perishable products. (e.g. banana grown in Central America is sold around the world).
- Food industry can take advantage of global seasonable variations (e.g. during winter the southern hemisphere can export fruits/vegetables to the northern hemisphere) & wage patterns.
- Source loading directly into a reefer extends the shelf life of product.
- Integrity of food cold chain is critical for food safety

Containerization & the Flexibility of Cold Chains



Temperature Recording Device



Ocean Reefer Storage at Port of New York/Newark

Shelf Life & Optimal Temperature of Food Products

Product	Shelf Life (Days)	Optimum Temperature (Celcius)
Apple	90-240	0
Bananas	7-28	13.5
Bell Peppers	21-35	7
Cabbage	14-20	1
Eggs	180	1.1
Onions	30-180	1
Lettuce	12-14	0.6
Fresh Meat (beef, lamb, pork, poultry)	14-65	-2
Oranges	21-90	7
Pears	120-180	-0.6
Potatoes	30-50	10
Seafood (shrimp, lobster, crab)	120-360	-17.8
Strawberries	5-10	0.6
Tomatoes	7-14	12

Meat Cold Chain Logistics

Cold Transport Chain	Transit Time (Days)	Typical Shelf Life (Days)
Refrigerated truck / Cold-storage facility transloading / Air	4-5	30-35
Refrigerated truck / Cold-storage facility transloading / Maritime shipping	15-16	30-35
Source loading with Reefer / Maritime shipping	15-16	55-60

Thank You!

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