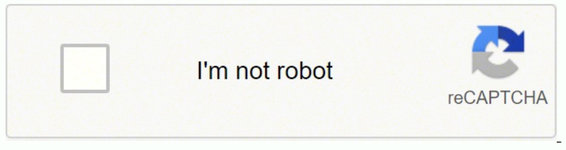

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Cold chain operations have substantially improved in recent decades, and the industry can answer the requirement of a wide range of products. Insulated pieces that are placed over or around freight to act as a buffer in temperature variations and to maintain the temperature relatively constant. The most common temperature standards are “banana” (13 °C), “chill” (2 °C), “frozen” (-18 °C) and “deep-frozen” (-29 °C), each related to specific product groups. Large shares of pharmaceutical and medicinal shipments are classified as chilled products, which means they must be stored in a temperature range between 2 and 8°C. Instead, it sublimates when it comes in contact with air.Gel packs. Source Loading of Chilled Meat in a ReeferCrownless Pineapples in Cold Chain Inspection RoomRefrigerated Urban Delivery Truck Therefore, the setting and operation of cold chains are dependent on the concerned supply chains since each cargo unit to be carried has different requirements in terms of location, demand, level of concentration, load integrity, and transport integrity. This is the step of the logistical process that creates trust and accountability, particularly if liability for a damaged shipment is incurred. Having conveyances available to move goods while maintaining stable temperature and humidity conditions as well as protecting their integrity.Cold processing and distribution. The Emergence of Cold Chain Logistics Since the 1950s, third party logistics providers began to emerge and institute new methods for transporting global cold chain commodities. Another issue concerns atmospheric control, which is maintaining appropriate oxygen and carbon dioxide levels, helping control (delay) the ripening. If problems or anomalies that compromise a shipment do occur, an effort must be made to identify the source and find corrective actions. It takes time and coordination to move a shipment efficiently, and every delay can have negative consequences, notably if this cargo is perishable. Skip to content The cold chain involves 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. Being able to ensure that a shipment will remain within a temperature range for an extended period of time comes down largely to the type of container that is used and the refrigeration method. Since many deliveries of cold chain products, particularly groceries, are taking place in an urban setting, they are impeded by congestion and parking difficulties Also important is the final transfer of the shipment into the cold storage facilities as there is potential for a breach of integrity and damages to fragile goods such as produce.Integrity and quality assurance. The load unit carrying the temperature-sensitive cargo must also be prepared. Specialization of agricultural functions permitting the transport of temperature-sensitive food products to distant markets. About 20% of all the energy consumed in cold chain logistics involves cargo refrigeration. Factors such as duration of transit, the size of the shipment, and the ambient or outside temperatures experienced are important in deciding what type of packaging is required, and the related level of energy consumption. The ongoing rise in standards of living and economic specialization will remain important drivers for years to come in the growing demand for perishable goods and the cold chain logistics supporting their transport. They can also be used in delivery vehicles to keep the temperature constant for short periods of time, a process that can be suitable for deliveries in noise-sensitive areas or for night deliveries.Liquid nitrogen. The industry has responded with the setting of temperature standards that accommodate the majority of products. After the shipment has been delivered, and temperature recording devices or known temperature anomalies must be recorded and made known. It is a technology since it relies on physical means to ensure appropriate temperature conditions along the supply chain. They are also known as “cold plates”. Temperature Standards for the Cold ChainMeat Cold ChainPalletized Bananas at a Cold Chain WarehouseReefer Containership entering the Zeebrugge HarborSubtropolis Underground Warehousing Facility, Kansas City 4. In all the supply chains it is concerned with, cold chain logistics favor higher levels of integration since maintaining temperature integrity requires a higher level of control of all the processes involved. Elements of the Cold ChainOperational Conditions of Cold Chain LogisticsMaintaining Temperature Integrity along a Cold ChainThe Cold Chain TechnologyIncome per Capita and Perishable Share of Food ImportsGrocery Chain Cold Storage Facility, Regina From a geographical perspective, the cold chain has the following impacts: Global. The standard method to provide this temperature is to use gel packs or packages that contain phase changing substances that can go from solid to liquid and vice versa to control an environment. Ballenger (2001) “Transportation Technology and The Rising Share of U.S. Perishable Food Trade”, Economic Research Service/USDA, Changing Structure of Global Food Consumption and Trade / WRS-01-1.Rees, J. Temperature control in the shipment of foodstuffs is a component of the industry that has continued to rise in relation to international trade. This could involve large cold storage facilities servicing regional grocery markets or specialized laboratories exchanging temperature sensitive components.Local. As a growing number of countries focus their export economy around food and produce production, the need to keep these products fresh for extended periods of time has gained in importance for commercial and health reasons. About 10% of medical drugs are temperature sensitive. From an economic development perspective, the cold chain enables many developing economies to take part in the global perishable products market either as producers or as consumers. For instance, a refrigerated container must be steam cleaned to remove the risk of bacterial contamination and brought to the specified conditions of the shipper, namely temperature and humidity. The main elements of a cold chain involve: Cooling systems. This is particularly relevant to the high value of cold chain goods. Different products require the maintenance of different temperature levels to ensure their integrity throughout the transport chain. Depending on the shipping requirements, these packs can either start off in a frozen or refrigerated state. Key considerations when arranging a final delivery concern not only the destination but the timing of the delivery, so the critical labor and warehousing space is available. If the freight crosses boundaries, custom procedures can become very important, since cold chain products tend to be time-sensitive and more subject to inspection than regular freight (e.g. produce, pharmaceuticals, and biological samples). This makes intermodal transfers critical for the cold chain. A key issue concerns the temperature conditioning and the packaging of the shipment, which should already be at the desired temperature. Intermodal shipments typically use 40-foot refrigerated containers that are capable of holding up to 26 tons of food. Dry ice does not melt. It can range from a single temperature-controlled room servicing a single user and function to a large dedicated distribution center servicing multiple users and functions. The last stage is the actual delivery of the shipment to its destination, which in logistics is often known as the “last mile”. For a range of goods labeled as perishables, particularly food (produces), their quality degrades with time since they maintain chemical reactions, which rate can be mostly mitigated with lower temperatures. (2013) Refrigeration Nation: A History of Ice, Appliances, and Enterprise in America, Johns Hopkins University Press. It is particularly used for the shipping of pharmaceuticals, dangerous goods, and foodstuffs and in refrigerated unit load devices for air cargo. The principle is similar to gel packs. Some goods can be damaged by shocks, while undue temperature variations can damage others. It is considered as a hazardous substance for the purpose of transportation.Quilts. 2. Quilts can also be used to keep temperature-sensitive freight at room temperature while outside conditions can substantially vary (e.g. during the summer or the winter).Reefers. The generic name for a temperature-controlled transport unit, which can be a van, small truck, a semi-trailer, or a standard ISO container. Timely distribution to the final consumer of perishables, namely grocery stores, and restaurants. Other concerns include the destination of the shipment and the weather conditions for those regions, such as if the shipment will be exposed to extreme cold or heat along the transport route. When a temperature-sensitive product is being moved, it is vital first to assess its characteristics. It may even incite third-party logistics providers to acquire elements of the supply chain where time and other performance factors are the most important, even farming. It is a science since it requires an understanding of the chemical and biological processes linked with perishability. The cold chain is thus a science, a technology, and a process. Cold storage. While globalization has made the relative distance between regions of the world much smaller, the physical separation of these same regions is still a very important reality. Customs issues are commonly identified as the most crucial in establishing reliable international cold chains.The “Last Mile”. Related Topics Bibliography Coyle, W. This may involve the acquisition of produce farms (e.g. orange groves) to ensure supply reliability. People with higher socioeconomic status are more likely to consume vegetables and fruit, particularly fresh, not only in higher quantities but also in greater variety. The cold chain is also a public health issue since the proper transport of food products will reduce the likeliness of bacterial, microbial, and fungal contamination of the shipment. Eutectic plates have a wide range of applications, such as maintaining cold temperatures for rolling refrigerated units. Thus, frozen freight will remain frozen for a longer time period, often long enough not to justify the usage of more expensive refrigeration devices. W. Cold Chains Operations Moving a shipment across the supply chain without suffering any setbacks or temperature anomalies requires the establishment of a comprehensive logistical process to maintain the shipment integrity. Specialization has led many companies to not only rely on major shipping service providers such as the United Parcel Service (UPS) and FedEx but also to a more focused industry that has developed a niche logistical expertise around the shipping of temperature-sensitive products. The environments in these containers are controlled electronically by either plugging into a generator or power source on the ship or truck as well as terminals and distribution centers. Distance between the origin and the final destination (which often includes a set of intermediary locations), the size and weight of the shipment, the required exterior temperature environment, and any time restrictions (perishability) of the product all affect the available transportation options. In this case, the cost/perishability ratio becomes a factor in the modal choice.Custom procedures. Clinical research and trials are a major part of the industry that costs millions of dollars, but one that also experiences a failure rate of around 80%. The potential to understand local rules, customs, and environmental conditions, as well as an estimation of the length and time of a distribution route, making them an important factor in global trade. They can range from small insulated boxes that require dry ice or gel packs, rolling containers, to a 53 footer reefer, which has its own powered refrigeration unit. Instead, plates are filled with a liquid and can be reused many times. Trucks and vans, the primary modes of transportation for this stage, must meet the specifications necessary to transfer the cold chain shipment. There are also punctual examples, such as converting mines into cold storage facilities. Whole new segments of the distribution industry have been very active in taking advantage of the dual development of the spatial extension of supply chains supported by globalization and the significant variety of goods in circulation. As a result, the logistics industry is experiencing a growing level of specialization and segmentation of cold chain shipping in several potential niche markets within global supply chains. This control can apply to the whole conveyance (reefer) but commonly involves wrapping products in polyethylene bags, which controls how gases permeate during transport.Modal choice. Using a reefer with its own power unit usually mitigates such concerns. It is a process since a series of tasks must be performed to prepare, store, transport, and monitor temperature-sensitive products. Hall, and N. Also, the ability to transport medical goods over long distances enables more effective responses to healthcare issues (e.g. distribution of vaccines). There are several means in which cold chain products can be transported, including refrigerated trucks and railcars, refrigerated cargo ships, reefers, and air cargo. For the case of pharmaceuticals, the value of the cargo can reach $50 million. The term reefer increasingly applies to refrigerated forty-foot ISO containers with the dominant size being 40 high-cube footers (45R1 being the size and type code). Within the pharmaceutical industry, for instance, the testing, production, and movement of drugs rely heavily on controlled and uncompromised transfer of shipments. Providing facilities for the storage of goods over a period of time, either waiting to be ship to a distant market, at an intermediary location for processing and distribution, and close to the market for distribution.Cold transport. Some domestic or transnational supply chains may only require one transportation mode, but many times ground shipments are only one link in a combination of transport modes. The major cold chain technologies in providing a temperature-controlled environment during transport involve: Dry ice. The container makes loading and unloading periods shorter and less susceptible to damage both on the container and its cargo. Any divergence can result in irrevocable and expensive damage; a product can simply lose any market value or utility. Therefore producers and retailers have responded with an array of exotic fresh fruits originating from around the world. It can support the specialization of production and economies of scale in distribution. Providing facilities for the transformation and processing of goods as well as ensuring sanitary conditions. Consolidating and deconsolidating loads (crates, boxes, pallets) for distribution. A large portion of the pharmaceutical products that move along the cold chain is in the experiment or developmental phase. It enables the distribution of vaccines and other pharmaceutical or biological products from single large facilities to any market around the world.Regional. Consumers with increasing purchase power have become preoccupied with healthy eating. To ensure that cargo does not become damaged or compromised throughout this process, businesses in the pharmaceutical, medical and food industries are increasingly relying on the cold chain. Bringing commodities such as food to the appropriate temperature for processing, storage, and transportation. The greater the physical separation, the more likely freight can be damaged in one of the complex transport operations involved. Several key factors play into how the shipment will be moved. These units, which are insulated, are specially designed to allow temperature-controlled air circulation maintained by an attached and independent refrigeration plant. An especially cold substance, of about -196°C, used to keep packages frozen over a long period of time and mainly used to transport biological cargo such as tissues and organs. A notable exception concerns bananas, which are transported around a temperature of 13o Celsius, for which it is possible to use a reefer to cool down the shipment. Along the transit process, they melt to liquids, while at the same time capturing escaping energy and maintaining an internal temperature.Eutectic plates. While a standard container load can have a value between $50,000 and $100,000, a reefer load can reach $1 million. In the United States, Food and Drug Administration restrictions and accountability measures over the stability of the cold chain incited many of these companies to rely on specialty couriers rather than completely overhauling their supply chain facilities. A common issue relates to sanitary inspection that may require fumigation. Because of the additional tasks involved, as well as the energy required for the refrigeration unit, transportation costs for cold chain products is much higher than regular goods. The reliance on the cold chain continues to gain importance. Increasing income levels are associated with a change in diet with, among others, growing demand for fresh fruit and higher value foodstuffs such as meat and fish. Staying within this temperature range is vital to the integrity of a shipment along the supply chain, and for perishables, it enables to ensure optimal shelf life. 3. The cold chain involves 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. A reefer is, therefore, able to keep the cargo temperature cool and even warm. If these shipments should experience any unanticipated exposure to variant temperature levels, they run the risk of becoming ineffective or even harmful to patients. The efficiency of cold chain logistics permitted the consolidation of cold storage facilities to service large market areas. The difficulty of this task differs depending on the nation (or economic bloc) and the gateway since there are variations in procedures and delays. This process concerns several phases ranging from the preparation of the shipments to final verification of the integrity of the shipment at the delivery point: Shipment preparation. Solid carbon dioxide is about -80°C and is capable of keeping a shipment frozen for an extended period of time. Cold chain devices are commonly designed to keep the temperature constant, but not to bring a shipment to this temperature, so they would be unable to perform adequately if a shipment is not prepared and conditioned. Providing Temperature Controlled Environments The success of industries that rely on the cold chain comes down to knowing how to ship a product with temperature control adapted to the shipping circumstances. Short distances can be handled with a van or a truck, while a longer trip may require an airplane or a container ship. Before their emergence, cold chain processes were mostly managed in house by the manufacturer or the distributor. The growth in income is associated with a higher propensity to consume fruits, vegetables, fish, and meat products. The cold storage facility is the most commonly used in cold chain logistics.

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