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Private Sector Competitiveness Enhancement Program

COLD CHAIN AND STORAGE ACTION PLAN

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Executive Summary

The USAID Private Sector Competitiveness Enhancement Program (PSCEP) is a $6.6 million, three-year program financed by the United States Agency for International Development (USAID) and the people of the United States, designed to promote the competitiveness of select sectors of the non-oil economy in Azerbaijan.

Agriculture in Azerbaijan provides 39.3% of all employment or 2.3 million workers (as compared to approximately 1% or 58,000 workers from oil) but only 6% of GDP or 4.5 billion USD (2008). Azerbaijan's major cash crops are grapes, cotton, tobacco, citrus fruits, and vegetables and all of these but cotton and tobacco are dependent upon an effective cold chain if they are to be economically viable and sustainable. The UN Food and Agriculture Organization estimates that approximately 40% of the value of these crops (or over US$2 billion) is currently lost due to the lack of adequate cold chain facilities. Accordingly, improvements in the country's cold chain segment of major cash crops such as fruits and vegetables will have a very significant monetary impact.

For this reason, PSCEP selected the cold chain segment of the value chain of many agricultural products as a "cross-cutting" independent sub-sector. Of course, it is not accurate to speak of cold chain and warehousing as one segment of the value chains. As describe below, in practice effective cold chain operations run from immediate post-harvest handling to consumers. The analysis and recommendations herein presented are based on extensive visits with 19 cold chain operators, discussions with numerous other stakeholders. They are also based on the author's extensive experience in this sector worldwide, as well as a review of cold chain literature in Azerbaijan and other countries.

A. Cold Chain Sector

Warehousing and cold storage are the central elements in the food harvest, preservation and distribution system and should not be considered in isolation, but rather as a part of a primary sector commonly referred to as the "Cold Chain." Constraints in the cold storage and warehousing sector in Azerbaijan go beyond a basic lack of capacity. Where cold storage exists, they also include a knowledge gap in how to build, run, and maintain a storage facility. Preventative maintenance schedules are lacking and rudimentary activities such as daily recording of cold chamber temperatures and humidity controls also seem to be missing. There are also problems of management and marketing of existing warehouse and cold storage facilities, which are often empty due to mismanagement. Finally, the fruit and vegetable sector as a hole lacks fundamental expertise in regards to post harvest handling of their crops. Given the importance of cold storage to many of the fruit and vegetable value chains, this is a sector where PSCEP could have a major impact.

B. Action Plan

PSCEP's sector strategy consists of a four pronged approach to enhance the sector competitiveness:

1. Firm level assistance, especially of key "anchor" enterprises, focused on addressing key constraints to increasing sales, increasing investment, creating jobs, and enhancing productivity;
2. Regionally and nationally focused sector level assistance, especially select multi-stakeholder training opportunities that address sector-wide issues and constraints;
3. Access to investment and finance, including sustainable commercial bank lending, equity investments, and joint venture and GDA promotion to address specific areas such as transportation logistics; and
4. Development of associative relationships.

This action plan is designed to not only provide specific enterprise level assistance, but will also ensure that support to the sector will be greater than the sum individual firm level assistance efforts.

PSCEP will provide technical assistance to targeted firms so they may learn the fundamentals of managing a cold storage warehouse and their costs structures or profitability drivers. Where cold store underutilization is a constraint, PSCEP will train management to address these issues, especially financial analysis.

PSCEP will also provide technical assistance to targeted firms on cold storage operations, maintenance, post harvest practices such as grading, sorting, packing and storage, as well as on transport refrigeration and cold storage construction. This in-depth technical knowledge is seriously lacking in the country. PSCEP and its BDS providers will help enterprises to assess their finance needs, including a proper financial structure. We will collaborate with these enterprises in preparing needed documentation for both debt and equity financing. While PSCEP will work at the enterprise level to enhance access to finance, it will also work at a more concerted, macro-level to achieve this objective. For example, PSCEP will work with the six commercial banks with which it has signed MOUs, the AIC, the CIIC, and the KAIC in their better understanding of the cold chain sector and its opportunities.

Where inadequate product sourcing is a constraint, PSCEP will provide assistance to selected warehouse/packers to establish more effective means of sourcing product including crop contracts, a cellular phone buying system, and other methods that may be termed relevant to the individual enterprise. At the sector or regional level PSCEP will develop a lean but effective training program for common constraints and issues impacting enterprises. For example, in late June, PSCEP will hold three-day workshops in Ganja and Lankoran to address post harvest technology relevant to their respective crops, an area where the assessment has identified across-the-board sector constraints. In August, PSCEP will follow with a national level conference on the same topic to discuss experiences since the July conference.

Transport refrigeration will be the subject a workshop that will be held in September that will present subjects including that will include the subjects of refrigerated transport basics, fleet operations, and contracting.

Expected results from PSCEP's efforts include:

- Over 15-20 enterprises directly assisted, increase sales and employment by 50% over the industry trend line.

- Over 100 individuals trained in cold storage operations and maintenance, including at least five regional and national workshops.
- Enhanced access to finance to these enterprises, exceeding US$30 million.
- At least two joint ventures secured with international investors which in addition to investment capital, provide technology transfer to the sector.
- Establishment of associative relationships such as regional and/or national associations or other forms of associative relationships.

SECTION II

Introduction

PSCEP is a three-year program designed to promote the competitiveness of select sectors of the non-oil economy to create jobs, increase exports, and generate investments. While working in over ten sub-sectors, agriculture is a major project focus. Rather than develop separate value chain assessments for the many agricultural products in which it will work (e.g., grapes, tomatoes, pomegranates, etc.), PSCEP has elected to address "cross-cutting" segments of these value chains that affect many subsectors. Cold storage and warehousing is one such segment. It is a critical area that the Government of Azerbaijan (GOAJ), the private sector, and donors have identified as a major constraint to the expansion and economic viability of agriculture in Azerbaijan. PSCEP's Domestic Resource Cost (DRC) study to identify sectors with comparative advantage in Azerbaijan also highlighted its importance.

This Action Plan provides first an assessment of the cold chain subsector, based on interviews conduced with nearly 20 enterprises, as well as numerous private and public sector stakeholders, and a review of existing information and data. It then includes a detailed strategic road map of how PSCEP can accomplish its sector strengthening and associative relationships objectives, including standards improvement, access to finance and capital, and market linkages. Although focused on cold storage and warehousing, it will also assess constraints, possibilities, and specific activities that could be implemented by PSCEP to increase sales and promote investments for the fruits and vegetables that will most benefit from cold chain services.

Constraints in the cold chain include not only a lack of capacity, but also the lack of expertise on how to use, build, operate, maintain and market the facilities. The most critical element missing is good management. Given the importance of cold storage to many of the fruit and vegetable value chains, this is an area where PSCEP can have a major impact.

A. Cold Chain Overview

Agriculture in Azerbaijan provides 39.3% of all employment or 2.3 million workers (as compared to approximately 1% or 58,000 workers from oil) – but only 6% of GDP or 4.5 billion USD (2008). Azerbaijan's major cash crops are grapes, cotton, tobacco, citrus fruits, and vegetables and all of these but cotton and tobacco are dependent upon an effective cold chain if they are to be economically viable and sustainable. The UN Food and Agriculture Organization estimates that currently approximately 40% of the value of these crops is lost due to the lack of adequate cold chain facilities. Just halving this amount would result in an increase in excess of 2.1 billion USD. Cold chain and warehousing is a critical value driver in agriculture, although until recently not appreciated as such by many agricultural stakeholders.

Warehousing and cold storage are the central elements in the food harvest, preservation and distribution system and should not be considered in isolation, but rather as a part of a primary sector commonly referred to as the "Cold Chain." Warehousing and cold storage facilities are typically "private" or "public," or a combination thereof. This definition is not related to the source of ownership, i.e., by individuals or by government. Rather, "private" facilities only store product owned by the facility

operator. This may be product originally produced by the operator or product acquired by the operator and held in storage to gain a higher per unit price. "Public" facilities are those which provide storage services to others for a fee.

B. Cold Chain Components

The term "cold chain" and the components thereof, refer to steps from harvest to consumption that extends the natural shelf life of a product by controlling temperature. Typical components of a cold chain may include post-harvest handling, refrigerated transport, refrigerated storage, controlled atmosphere storage (CA), chilled or frozen processing, cold storage holding and/or distribution, retail refrigeration, institutional refrigeration, and home refrigeration.

Any food begins to deteriorate or lose quality upon harvest whether it is meat, poultry, seafood, dairy, fruit or vegetable. Most also continue to produce heat and in some cases ripening gases, even after harvest. Removing the heat from these products and maintaining product temperature and/or storage atmospheric composition, by chilling, refrigerated storage, CA storage or freezing reduces the rate of deterioration and extends the shelf-life of the product. In addition to protecting quality, application of the appropriate cold chain components provides flexibility by making it possible to market products at the optimum time.

Temperatures maintained in cold chain storage facilities may be divided into "refrigerated" and "frozen" categories. Refrigerated temperatures are typically those above 0^oC (32^oF) and frozen temperatures those lower than 0^oC. Typically fresh meat, poultry, seafood, milk, flowers, fruits and vegetables are held at 38^oF or 4^oC while some products such as strawberries, cucumbers and tomatoes are held at higher temperatures due to sensitivity issues. Frozen storage temperatures normally include two common categories, -18^oC (0^oF) and -29^oC (-20^oF); the latter often referred to as "ice cream temperature." Lower temperatures may be specified for specific products such as sashimi grade tuna -62^oC (-80^oF) but are not common. Temperatures used to freeze products are normally lower than storage temperatures.
Proper storage and warehousing is not only integral to maintaining quality, but to increasing prices for producers and/or distributors and providing consumers the benefit of longer consumption seasons.
The major cold chain components are described below.

B1. Post Harvest Handling

The internal heat of seafood, meat, poultry and milk must be removed immediately upon harvest if the quality of these products is to be maintained. Most fresh fruits and vegetables also require thorough cooling immediately after harvest in order to deliver the highest quality product to the consumer. Producing consistently high-quality products and the ability to ensure that quality is maintained until the product reaches the consumer commands buyer attention and gives the grower a competitive edge. This is rare in Azerbaijan.

Postharvest cooling rapidly removes field heat from freshly harvested commodities before shipment, storage, or processing and is essential for many perishable crops. Proper postharvest cooling can:

- Suppress enzymatic degradation and respiratory activity (softening)
- Slow or inhibit water loss (wilting)

- Slow or inhibit the growth of decay-producing microorganisms (molds and bacteria)
- Reduce production of ethylene (a ripening agent) or minimize the product's reaction to ethylene.

Typical methods of postharvest cooling include icing, hydrocooling (using chilled water immersion or spray), evaporative, vacuum, and forced-air cooling. An even simpler method is to harvest the produce at night or in the coolest part of the day, but this is not always possible or effective due to ambient air temperatures that may be present.

B2. Refrigerated Transport

This may include long haul refrigerated equipment including truck/trailer combinations, containers, specially designed rail cars, and equipment appropriate for air transport. Local delivery equipment may include smaller truck/trailer units, truck units, or even units that are well insulated but lack integral refrigeration equipment. Shipments of frozen or refrigerated meats by sea occurred as early as the nineteenth century (lamb and mutton from Australia to England) using a combination of salt, ice and sawdust; the first operational mechanical refrigeration system was developed by an American physician, John Gorrie in 1842 and the first commercially successful refrigerated ship, the New Zealand vessel Dunedin began operations in 1882 and led to a rapid expansion of meat and dairy exports from Australia, New Zealand and South America. However, railroads using ice and specially insulated railcars really pioneered the transportation of significant quantities of meat and produce beginning in the mid to late nineteenth century. By the mid-twentieth century, the rail cars were converted to mechanically refrigeration using diesel or electric powered units and currently many of these rail cars, as well as newly constructed ones have had those units removed and now employ end mounted truck/trailer units. The advent of intermodal units (refrigerated trailers or containers) markedly increased the capacity of rail systems to economically transport large volumes of refrigerated and frozen products throughout much of the world. While a few “refrigerated break-bulk” freighters still exist, the vast majority of sea borne refrigerated transport is now done in containers.

Once the initial heat is removed from the produce it should be immediately transported to the customer, packing house or cold storage facility, preferably in refrigerated trucks and/or trailers. Every effort should be made to insure the product does not regain heat during transportation. Unfortunately in many developing economies, and most assuredly in Azerbaijan, growers and traders often transport their product to market in a myriad of unrefrigerated vehicles ranging from tractor pulled carts and overloaded sedans with the seats removed and packed to the gunnels with produce, to trucks of every description including dump trucks. As noted above, refrigerated transport in Azerbaijan is the exception and certainly not the rule mostly being applied to local delivery of higher value foods and to produce exports.

B3. Refrigerated Storage

Often associated with packing houses, these facilities hold the harvested products until distributed. Distribution may occur concurrent with the harvest, or may be at a later date, when the commodity is no longer in season and its price has increased thus permitting the grower, or the trader, a greater return on investment. This latter period in Azerbaijan normally does not exceed six months, but in more developed economies product, particularly frozen product, may be held for a year or more. Environmental humidity is also a critical factor in storing fruits and vegetables for an extended time.ost fruits and vegetables should be stored in storerooms with humidity in excess of 85%; the exception being onions and some other products that require lower humidity in the range of 75%.

B4. Controlled Atmosphere Storage (CA)

CA is a particular variant of cold storage in which the atmosphere in the storage room is controlled to inhibit ripening and/or degradation of the quality of the product. The most common atmospheric gases controlled are Oxygen (O_2) and carbon dioxide (CO_2). Properly packed and waxed fruit such as apples can maintain good quality using CA for up to a year.

B5. Chilled or Frozen Processing

Value may be added to a product by chilling, packaging, or freezing; the latter enabling significant extension of the product's shelf life. Chilling is normally associated with additional packaging, including packaging in which the atmosphere within the packaging may be modified by the addition of gases or by the use of gas-specific permeable films. The chilled products are then held at refrigerated temperatures throughout the subsequent distribution chain.

Frozen food s are processed to a temperature, normally below -18^{o}C (0^{o}F) and held at this temperature until just before consumption or in some cases just prior to retail selling. Fruits and vegetables often require blanching prior to freezing to arrest enzymatic activity. Product may be frozen in bulk or individually (IQF or Individually Quick Frozen) using a variety of methods such as blast, blast-spiral, fluidized bed, tunnel, and cryogenic freezing.

Particularly high value products may be freeze-dried. Freeze drying is a process in which the food is frozen and then the solid water (ice) is converted directly to gas (water vapor) by sublimation. Freeze dryers operate at the triple point of water, this is the point at which water can exist in a solid, liquid and vapor state simultaneously at a given pressure. To complete the drying at moderate temperatures that will not adversely affect the structure of the product, the dryer must be under a very high vacuum (e.g. 10 milliTorr), with a condenser at a very low temperature (e.g. -50^{o}C/-46^{o}F). Maintaining these operating conditions is one of the reasons freeze drying is expensive and why it is used for only very valuable products or ones for which rapid rehydration is critical. Another is that it takes a long time, usually on the order of a day or more, to dehydrate even small pieces of food using this technique. The product that results can be stored in appropriate packaging that provides a vapor transmission barrier for exceptionally long periods at ambient temperatures.

B6. Cold Storage Holding/Distribution

Cold holding and distribution centers tend to be located closer to markets or transportation hubs and are designed to hold product awaiting local or regional distribution to retail, institutional or commercial markets. Turn-over and the variety of products held in these facilities are much greater than those located closer to growing areas although a combination of the two is quite common. They often feature higher ceilings, more individual cold storage rooms, multiple product holding temperatures (but predominantly +4 ^{o}C (fresh produce, and -18 and -24^{o}C for frozen). They do have more sophisticated product handling equipment, that are often automated and may include rack systems. Due to the high rate of product entering and departing, these facilities also tend to devote more area to product handling facilities such as multiple loading docks and staging areas. Also associated with such facilities are brokerages (traders), freight forwarding, customs clearing, packing/re-packing, and other service vendors.

Frozen food distribution warehouse with rack storage, Afghanistan

Barakat chilled produce distribution warehouse, UAE

B7. Retail, Food Service and Institutional Refrigeration

"Commercial Refrigeration" is a term often used to describe refrigeration equipment designed for retail, food service (restaurant) and institutional refrigeration. At the retail level this may include refrigerated or frozen display cases, refrigerated beverage dispensers, and vending machines. Although once a rarity in Azerbaijan, such retail fixtures are becoming more common, particularly those operating at refrigerated temperatures (>0^0C). Food service and institutional refrigeration units range from smaller reach-in units and temperature controlled serving/preparation tables to larger walk-in units. The latter are typically constructed of pre-formed, interlocking insulated panels and modular refrigeration systems; most typically using evaporator units in the refrigerated box and air cooled condensing units.

B8. Home Refrigeration

The number of home refrigerators per household has become a common indicator of the economic development of a nation, right behind air conditioners and color televisions. Less common are home freezers, although most home refrigerators have at least some frozen food storage capacity. A typical home refrigerator consists of an insulated box, cooled by a hermetically sealed electric powered system. The number of home refrigerators and freezers per household has become a common indicator of the economic development of a nation. There are no reliable statistics readily available that report the number of households in Azerbaijan with home refrigerators and/or freezers. The "Baku Refrigerators Plant" was established in 1959 and reportedly manufactures between 10 and 15 thousand home refrigerators each year. However, it is reported that Azerbaijani prefer imported refrigerators to those produced in country. In February of this year, it was also reported that Belarus, a major importer of refrigerators to the country will enter into a joint venture with the Baku plant to increase production. Several European brand refrigerators are also available at retail facilities and newly constructed condominium/apartment units in greater Baku area are all equipped with home refrigerator/freezers. Once outside of the urban areas, the ownership of home refrigerators is considerably less common, but the number of units also continues to increase albeit at a much reduced rate. Accordingly, it is expected that the demand for frozen and packaged refrigerated products will continue to grow as it has in almost every other developing nation.

B9. Supporting Infrastructure

Like any sector, an efficient and sustainable cold chain requires a supporting infrastructure that includes: trained management; operations and maintenance personnel; relevant educational and training institutions; individuals or companies experienced in construction of cold chain facilities; sales, parts, and service of equipment; vendors of packaging and consumables; an effective transportation system;

adequate and affordable energy; government support and regulation that is equitable and supportive; and finally, but not the least in importance, adequate and affordable financing options both short and long term.

In the case of refrigerated transport containers, the most common system used world-wide to ship perishable commodities, an effective infrastructure also includes enterprises capable of inspecting and servicing the equipment (Pre-tripping) so that it can be reloaded with cargo for the backhaul (return trip), thus reducing overall shipping costs.

SECTION III

Cold Chain Sub-sector Assessment

A. Overview

This section provides and overview of Azerbaijan's cold chain sub-sector and analyzes key segments of the value chain. It further presents the sub-sector's strengths, weakness, opportunities, and threats, laying the groundwork for the Action Plan recommendations in the next section.

A1. Facilities

Preparation of this Assessment/Action Plan included visits to 19 existing Azerbaijan cold storage facilities. A list of these and other known such facilities in Azerbaijan was compiled and is attached to this report as Attachment 1- *Directory of Warehousing and Cold Storage Companies*. Most of these warehouses were "public" (stored product for others for a fee) or a combination of "private" (store product that the company owns) and public. The private facilities were predominantly owned and operated by parties who purchased agricultural product at harvest and held these products until post harvest price increases were realized. Most owners of cold storage facilities expressed strong preferences for the private mechanisms, i.e.to only store product they owned and that they would sell into the much higher post harvest market.

There are only two facilities visited that could be classed as "large:" The NAA facility in Ganja, with 30 storage rooms and the new NJT facility at Salyan which is still under construction. Both are combination distribution and initial storage facilities. The remaining are smaller, regional facilities.

Azerbaijan has four primary agriculture production regions: (1) Lankoran and the southeast regions which produce citrus fruit and vegetables; (2) Ganja to the west where grapes, greenhouse vegetables, and tree fruit predominate; (3) Guba to the north where the primary crops are tree fruits; and (4) the Seki/Zagatala/Balacan (SZB) region which is known for tree nuts but also produces tree fruits, tobacco, grapes, and vegetables (some in greenhouse). Six of the twenty four listed facilities are located in the Ganja region, five in Guba, and three each in the Lankoran and SZB. All of these are primarily initial storage/packing warehouses. There are seven facilities in the Baku area and most are distribution warehouses with the exception of Agro Servise which purchases and packs potatoes and onions for local and export markets.

Some cold storage warehouses have been recently constructed in the Guba and Ganja regions and the aforementioned large NJT packing/distribution center is currently under constructed in Salyan (between Baku and Lankoran). All of these facilities use Freon based refrigeration (R404A and to a lesser extent R-22) equipment purchased from European sources, most notably the Netherlands, Germany and Turkey. The size of some of the facilities warrant the more economical use of ammonia refrigerants (R-717), but this was not used perhaps as a result of prior poor experience with Soviet built systems that were notoriously hard to maintain and prone to leakage. This is significant, as ammonia is increasingly finding acceptance as an alternative refrigerant for new and existing refrigeration systems throughout the world. It has a low boiling point (-28°F at 0 psig), an ozone depletion potential (ODP) of 0.00 when released to atmosphere, and a high latent heat of vaporization. In addition, ammonia in the atmosphere does not

directly contribute to global warming. These characteristics result in a highly energy-efficient refrigerant with minimal environmental problems. From a purely economic analysis, ammonia should find broader applications as a refrigerant than it currently enjoys.

A2. Transportation

None of the companies interviewed owned or operated refrigerated transport other than some smaller local delivery units. For the most part product was shipped in un-refrigerated transport or in Russian owned trailer units contracted by either the Azeri trader or the Russian buyer. One company, MNR-Azerbaijan Fruit Co., which operates four cold storage warehouses and a box factory in Guba, expressed the desire to purchase and operate a fleet of 50 refrigerated tractor trailer combinations. This company currently contracts annually with Russian companies for over 500 trailer loads of produce (20MT per trailer) for export and believes they could experience substantial cost savings and increased revenues with such a fleet. There are good possibilities for PSCEP to assist the companies in this objective (see Section IV, Action Plan).

A3. Operations

Almost universally, the companies lacked experience in operating and maintaining modern cold storage facilities, most certainly in a free market and competitive system. There was only general knowledge of optimum temperatures and conditions for the storage of fresh produce and considerable disinformation on current technical processes for extending shelf life of these products, particularly tree fruit. Four of the newly constructed companies rely upon initial manufacturers' warranty and maintenance services, while one actually uses an internet based system monitored by the company in the Netherlands from which they purchased their equipment.

Preventative maintenance is virtually non-existent and none had plans for continued maintenance of their facilities once the initial 1-3year warranty period expired. Further, only one company, Ikar MMC of Guba, centrally monitored temperature and systems performance although most manually monitored storeroom temperatures at least daily. None had temperature recording devices which are critical to most food protection programs and of paramount importance in maintaining in substantiating that the product has been stored under appropriate and consistent conditions necessary for higher valued products. Further, none of the facilities visited had formal sanitation or other food protection plans, prerequisite for participation in the international export trade with most of the world. These are serious deficiencies which need to be addressed if the sector is to become competitive.

The largest of the firms visited, NAA of Ganja, has remodeled and existing warehouse creating thirty cold storage rooms and is in the process of remodeling additional space into a packing and processing facility. Additional plans include the construction of an integrated greenhouse complex and the construction of a wholesale fruit and vegetable market on adjacent property. Of almost equal, if not a greater, net available storage size is the new NJT facility near Salyan on the Lankoran-Baku highway which also features an integrated processing and packing capacity. Most remaining facilities consisted of two to six storage rooms, the majority of which are designed for chilled temperatures (above freezing). None had of the facilities had automatic picking systems or integrated rack systems and thus had ceiling heights of six meters or less on the average. Accordingly product was not packed very high although

some firms employed corner bracing or inter-nested boxes to permit higher stacks and thus use of more available cubic space. Unfortunately, none of the facilities had been constructed with the eventual addition of rack systems, the latter markedly increasing the capacity to utilize the maximum amount of space within a storeroom but having the disadvantage of requiring a substantial bearing surface.

A4. Costs

Storage fees were not standard and most operators were reluctant to discuss the subject although it appears that a price of 250 AZN per month per ton is not unusual. Few of the new facilities were even near to full capacity with product. Indeed, the larger ones did not have enough apparent product to support minimal operating costs. The exception to this was AgroServices MMC of Baku which had limited storage which was entirely empty due to a lack of input product and who expressed the desire to increase production if they could but find a reliable source of potatoes. Accordingly, they were entering into contracts with some growers to produce potatoes and other crops to maintain a consistent supply for future operations.

There were several reasons given for these new facilities being empty. It being winter, most of the previous year's harvest had already been sold at post harvest prices; the exception being some persimmons which are a late fall harvest crop, with some harvests continuing as late as December. Secondly, it was the result of a lack of operating capital on the part of private warehouse owners who could not acquire the short term financing needed to floor products that would be held for a longer post harvest period and farmers who because of a similar lack of short term funds had to sell their crops at harvest time. Additional reasons given included the problem of farmers not knowing the sellers or even the existence of available public cold storage and warehousemen not knowing, how to extend the storage time for fruit such as apples by application of controlled atmosphere conditions as well as cleaning and waxing the fruit prior to storing. Helping to establish linkages between producers and warehousing cold chain facilities should be an important area for PSCEP.

As discussed above, operators necessarily forthcoming in regards to operating costs, but it often appeared they really did not have a handle on the full cost of operating their facility. Most expressed a general cost of approximately 1000AZN per month for the average sized units. None seem to be particularly concerned about the cost of energy although four were purposely located near railways from which they secured a reliable source of electricity. Energy costs are of significant concern globally to most cold chain facility operators and it should be expected will become of major concern to those of Azerbaijan as well in the future.

A5. Constraints

Consistently, the individuals interviewed stated that their major constraints to increased operations were: (1) the lack of available operating capital; (2), the dearth of reliable production and market information; (3) a lack of consistent and reliable raw materials; (4) absence of packing materials at affordable costs; (5) a fragmented wholesale market system, and; (6) burdensome "indirect" costs, including rent-seeking behavior on the part of local authorities. Additional concerns included the lack of post-harvest cooling and of transport refrigeration. Further, the role and availability of cold chain facilities is not well known

amongst the majority of Azeri producers and many traders as was evidenced in discussions with members of these groups and the management of several of the newly constructed warehouses.
The PSCEP DRC reported substantiated these findings stating: "Constraints in the cold storage and warehousing sector go beyond a basic lack of capacity. They also include a knowledge gap in how to build, run, and maintain a storage facility. Preventative maintenance schedules are lacking and rudimentary activities such as daily recording of cold chamber temperatures and humidity controls also seem to be missing. There are also problems of management and marketing of existing warehouse and cold storage facilities, which are often empty. Given the importance of cold storage to many of the fruit and vegetable value chains, this is a sector where PSCEP could have a major impact."

B. Markets

Azerbaijan's trade with Russia and the other former Soviet republics (CIS) has reportedly declined in response to the decline of those economies. The DRC analysis undertook sensitivity tests on the value of the Russian ruble that determined that many Azerbaijani agricultural products were still competitive, even at current rates. But this does not take into account decreased consumption in Russia and elsewhere simply due to a slumping economy and decreased incomes. On the other hand, trade is reportedly increasing with Turkey and even some small penetration of EU countries. However, when petroleum is removed from the equation, CIS countries, primarily Russia, account for approximately ninety five percent of exported fruits and vegetables. Domestic consumption remains the major market for most agricultural products but figures clearly delineating the division of agriculture sales to domestic and export markets are not present. The problem is further complicated by the lack of reporting on many sales as well as the prevalence of bartering in some instances.

The main domestic market is Baku where domestic production experiences stiff competition from agriculture imports from Iran and Turkey as well as the effects of monopolies such as the case with lemons.

C. Effects of the Application of Cold Chain Services

The effects of the application of cold chain services, principally cold storage following harvest and initial processing/packing, typically result in an increase in a higher post-harvest or "non-seasonal" price as compared to the market price at time of harvest. This is particularly significant when the products have the potential to realize even greater returns on investment as exports to higher valued markets. The DRC study addressed export and domestic consumption issues, establishing "DRC values" for many products. The DRC concept is relatively simple: it measures the efficiency by which a unit of scarce domestic resources produces or saves a unit of foreign exchange. If the DRC is less than one, the value of resources used in production is worth less than the foreign exchange earned or saved and the country has a comparative advantage; if the DRC is greater than one, the value of resources used in production is worth more than the foreign exchange earned or saved and the country has a comparative disadvantage.

Azerbaijan agricultural products most vulnerable to lack of appropriate storage facilities, and conversely stand to gain the most when they are present, include apples, persimmons, cherries, tomatoes, cucumbers, pomegranates, potatoes, and to a lesser extent certain varieties of citrus fruit. FOB prices of product held

in cold storage in Baku, Guba, Lankoran, Ganja, and Sheki/Zagatala resulted in tree fruit such as apples (DRC= 0.14 - 0.31) experiencing a doubling in market price after an average of three to five months of refrigerated storage, persimmons (DRC= 0.90) doubled in price after only two months, other fruits, such as cherries (DRC= 0.10 – 0.17) and nectarines (DRC not calculated), were not held long enough to realize a significant seasonal increase but traders did state that harvest value was increased by initial chilling and packing. Pomegranates (DRC= 0.76) are particularly sensitive to seasonal/non-seasonal price differentiation. A USAID funded study of the pomegranate value chain reported seasonal variations for sales to traders that exhibited a 260% increase in price by winter and 528% by spring. In a similar vein, bazaar prices increased by from harvest to mid winter 318% and 454% by spring. The report also listed the lack of available cold storage as a major constraint for realizing the best prices by farmers for their pomegranate crops. Tomatoes (DRC= 0.16 – 0.93), cucumbers (DRC= 0.16 – 0.93), and other ethylene sensitive vegetables experienced doubling in price reportedly after only one to two months holding while some individuals reported that early potatoes (DRC= 0.21) provided their greatest profit and experience a doubling of price also in just two month of refrigerated storage; though the latter may be related as much to packing and marketing as to cold storage.

There is also growing production of kiwi fruit and berries, particularly strawberries, the result of increased demand in local and export markets. These commodities are very dependent upon the availability of reliable cold chain facilities, including good transport refrigeration, when it comes to maintaining quality.

The simple formula presented below evaluates the benefit or added profit of cold storage and related processing to the realized price of fruits and vegetables:

$$\text{Profit added} = \frac{\text{Post Harvest Sales Price - Harvest Price}}{\text{Cost of Value Added Activities}}$$

Valued added activities included the following items:

- post-harvest cooling
- transport in
- storage
- packing, grading, and processing
- transport out
- marketing and Sales

It should be noted that domestically produced fruit such as apples seldom sell for more than 50% and more commonly are 30% of the price realized by imported competitors such as Washington State apples which are found in most Azerbaijan markets. Further, shelf life of Azeri apples was reported to be only about six months as compared to approximately one year for US origin apples. This disadvantage is characteristically indicative of the lack of sorting and grading measures as well as the use of rapid post harvest cooling and controlled atmosphere storage coupled with the addition of vegetable wax to the fruit's surface; simple, but effective steps.

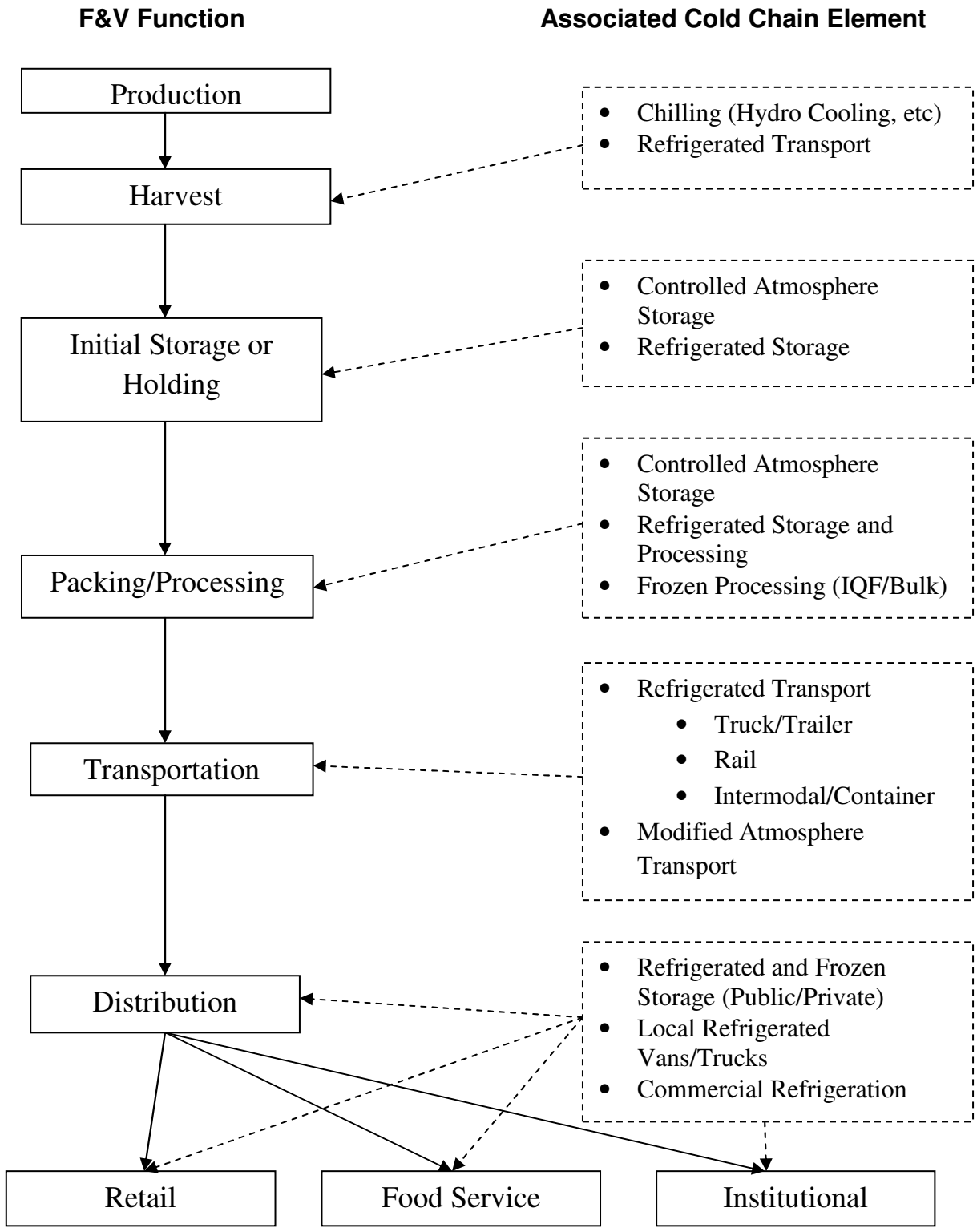
D. Value Chain Description and Mapping

The diagram on the following page presents a simplified fruit and vegetable value chain with the cold chain elements associated with the various links of that chain. The application of the cold chain elements

may be conducted by the producer, the subsequent purchaser, a fee provider such as public cold storage or contract hauler, or a combination thereof. There is very little if any initial chilling of crops in the field and little initial rapid chilling of the crops once they reach the first storage facility. Indeed, most of the initial removal of heat was incidental to the simple storage of the product and did not incorporate accelerated or increased refrigeration. Further, none of the individuals interviewed reported the use of refrigerated transport for the initial hauling of the crop from field to storage. At least one company, though, Guba MMC is interested in acquiring hydro cooling equipment to be used on crops they purchase and on a fee basis for others. It is interesting to note that the owner of the company stated that he learned of hydrocooling and the importance of cold chain activities during a US sponsored visit to the United States in 2005.

As previously reported, some of the cold storage facilities have controlled atmosphere capacity and many have humidity control equipment as well. Most facilities examined are dual public/private facilities and most of these stated that if they had available capital they would purchase sufficient product at harvest to meet capacity and withdraw from providing public cold chain services.

Simplified Fruit and Vegetable Value Chain with Associated Cold Chain Elements:



E. Strengths, Weaknesses, Opportunity, and Treat Characteristics of the Value Chain

Table 1: S.W.O.T. Summary

Strengths:
• Strong fruit and vegetable production that is increasing and enjoys a strong market demand • Growing affluence of locals with increases demand for safe and quality products • New refrigerated warehouses have been constructed/remodeled but do not meet increasing needs • Continuing improvements to the country's highway and farm to market road system • Well-established railroad system
Weaknesses:
• Fragmented farm sales and farmers with weak post harvest knowledge • Very poor awareness as to availability of cold chain facilities and services • Azerbaijan products perceived as cheap and of low quality in some export markets • Lack of diversity in markets • Lack of fully knowledgeable refrigerated warehouse constructors and suppliers • An ineffective refrigerated railroad capacity • Presence of monopolies, unofficial charges and payments, as well as other non-tariff barriers
Opportunities:
• Need for new facilities with increased capacity and technology • Need for domestic refrigerated transport providers • Improved added value of existing products by grading, sorting, and improved packing • Development of markets other than those of Russia and the other • Use of the regional East-West transportation network running from Turkey and the Black Sea, across the Caspian Sea as far as Masar-i-Sharif in Afghanistan.
Threats
• Devaluation of Manat (AZN) (as operators, with borrowings often tied to foreign currencies) • Devaluation of Russian and CIS currencies accompanying deepening economic crisis there • World-wide reduction in supply of investment capital; • Increased donor sponsored/government investment cold storage facilities that compete directly with those of the private sector. • Unchecked rent seeking behavior within Azerbaijan • Over aggressive role in government development of cold chain facilities, crowding out private programs.

E1. Strengths

The Azerbaijan agricultural sector and supporting cold chain facilities strengths are distinguished by **strong comparative advantages in fruit and vegetable production** that is increasing and enjoys a strong market demand for these products. **Growing affluence of the domestic population will increase demand for safe and quality products** as it has in other developing economies in the region. Upscale

food markets such as the Turkish owned Ram Store, as well as the locally owned Neptune, City Market, Continental Market and M&T Meats have expanded their fresh and frozen food lines in the past three years and are concentrating more on presentations that provide the perception of safe foods. Ram Stores alone has doubled its frozen food display capacity since mid-2005.

Private investment is responsible for many new refrigerated warehouses constructed in Azerbaijan in the past three years and several older facilities have been upgraded using modern technology. Most have electronic temperature readouts (although automatically recorded data logs and remote monitoring systems are quite rare), many store rooms have humidity controlling equipment and a few are equipped for controlled atmosphere storage. Several additional new facilities are under consideration and even some in construction at this time. There is also a large multi-purpose facility being currently constructed south of Baku near Salyan thru a joint venture between Azerbaijani and Turkish owners. This facility has an associated packing house and two main freezer buildings, one of which is equipped with a blast freezing room. The facility also features Controlled Atmosphere storage and a chilled staging area for receiving and shipping of refrigerated products. The manager of the facility is a Turkish-Cypriot with reportedly extensive experience in refrigerated storage some of which was gained in the United Kingdom.

NJT Cold Storage Facility near Salyan Baku-Lankoran Highway

Interior showing chilled staging area

Concrete slab being poured and worked with reinforcing mesh left on base

Additional strengths include **continuing improvements to the country's highway and farm to market road system**, a well established railroad system with major routes running North/South into Russia and East/West into Georgia and terminating at the Port of Poti with its free economic zone formed thru an agreement with between Georgian and the United Arab Emirates (UAE) providing seaborne container access to market in the UAE, Middle East, North Africa, Europe, the US and other world markets. The rail system continues across the Caspian Sea and has the potential to provide rail service into Northwestern Afghanistan (near Mazar-i-Sharif) as well. Although the rail system at this time is poorly equipped to reliably handle refrigerated transport, it does have the potential to do so. There are also regular air shipments of higher value produce, particularly greenhouse grown tomatoes, cucumbers, herbs and greens to export markets, particularly in Russia. There is direct air service dedicated to this purpose from Ganja to Russia which operates on at least a twice weekly basis with increased service seasonally.

In regards to capital funding availability, **there are financial institutions such as the Azerbaijan Investment Company, the Caspian International Investment Company (CIIC), and the Kuwait Azerbaijan Investment Company (KIC) that have exhibited interest in providing funds for cold chain capital construction**. What is also important is that the GOAJ and local governments have made a strong commitment to the growth of agriculture in general and specifically toward the development of more modern processing and cold chain facilities. Construction of a proposed new natural gas pipeline

and continued exploitation of Azerbaijan's petroleum and natural gas resources should meliorate the effects of the current world wide recession and permit continued growth within the country, albeit at a reduced rate.

E2. Weaknesses

Weaknesses in the sector include: fragmented, small farms, often with limited economies of scale: weak post harvest knowledge on cold chain principles to improve their net revenues and very poor awareness amongst users/potential users as to availability of cold chain facilities and services; a lack of diversity in markets; a dearth of fully knowledgeable refrigerated warehouse constructors; an ineffective refrigerated railroad capacity; and finally, punitive "indirect expenses" (monopolies, unofficial charges and payments, as well as other forms of rent seeking behavior).

The vast majority of Azerbaijan farms are small which can be an advantage that results in more intensive farming efforts and closer attention to individual crops. But it also **results in smaller farm gate sales and increased costs in sourcing product by processors and traders**. Past efforts to assist these farmers have been primarily directed toward the horticultural aspects and the dissemination of market information has been more related to spot market prices and trends. This has resulted in a general lack of sophisticated marketing efforts by farmers.

Contract farming, where the farmer grows a crop specified by the buyer and agrees to a pre-arranged price or conditional price, **takes place, but is not often implemented in a way satisfactory to both producers and processors**. Yet this mechanism is particularly important, in light of efforts to restore an ever increasing acreage to productivity. Under such contracts, the buyer typically provides inputs such as seed, fertilizer and even cash advances to the grower in return for the right to purchase the crop at harvest. This provides a stability to processors and traders that enable them to make advance production, distributing, and marketing decisions; decisions that should result in higher net revenues for all parties. One individual interviewed, who also operated an integrated cold storage warehouse with integrated processing and packing and his own farm, stated that to gain sufficient grapes, cherries and apples to meet his sales demand, he had to employ and support three individuals to daily travel throughout the region calling on individual farmers and buying what products they had available for sale on that particular day. The result was an expensive mix of varieties and qualities inconsistent with maintaining and efficient packing/processing system and negatively contributing to the ability to market products of consistent quality and variety. Net result: higher input and operating costs with lower market price and net revenues. Coupled with this somewhat ubiquitous problem, was the inability of most processors/traders to secure short-term funding to cover the cost of acquiring, processing and holding fruits and vegetables long enough to fully realize the increase in market price due to these activities. Organizing and forging relationships between producers and processors is clearly one area in which PSCEP could play an important role.

Further, **the Azerbaijan agriculture export market is dependent upon too few customers** with over 95% of exports reportedly going to regional Commonwealth of Independent States (CIS), predominantly Russia where Azerbaijan is noted as a reliable supplier of low cost produce. The Russian market is also supported by a network of Azerbaijan expatriates involved in marketing and distribution. This is a critical

vulnerability and one which Russia has exploited in past years with disastrous effect on pricing. An example of which was the closing to the Azerbaijan/Russian border during the 2004 apple harvest in Guba that resulted in a 60% reduction in market price and the dumping of other crops such as pears into local irrigation canals and/or composting of these valuable crops. Accordingly, it would behoove the industry to look for other export markets as well as to increase domestic sales at the expense of imports. To do so will require that better grading, sorting, packing and packaging practices be employed as well as developing improved refrigerated transport capacity. This is one area where the Azerbaijan rail system could play an integral part. Refrigerated transport on the systems is almost non-existent with most of the few existing units being dedicated to the transport of products to and from Russia. The introduction of intermodal and/or reliable refrigerated rail service, particularly on the East/West system would significantly improve the ability of fruit and vegetable marketers to compete more profitably in the international market.

There is also a **lack of adequate, implemented food protection programs** that are increasingly required by international markets. Implementation of such programs would permit exports to more profitable markets as well as to preserve the markets they now have in Russia which has recently began insisting upon improved food safety for imported food products.

It should be noted that the FAO estimates that the lack adequate cold chain services, including refrigerated transport, cumulatively, these factors contribute to a reported loss of approximately 30-50% of the fruit and vegetables value due to lower resultant market prices as well as direct loss due to spoilage. As noted above, the implications are that over US$4 billion in agricultural value is lost due to poor cold chain management or its absence.

From the operational perspective, the existing cold chain facilities are characterized by the **lack of entrepreneurial/business knowledge** required to successfully operate the business side of their operations, the day to day procedures required for product protection and inventory control, poor construction procedures, and of maintenance procedures critical to sustaining the capabilities of the existing and newly constructed facilities. The latter are quite critical due to a general lack of local refrigeration sales and service support. Managers of Azerbaijan cold chain facilities, with a few exceptions, lack training and experience in operating their facilities particularly in a free market environment. PSCEP could provide training in these and several other areas.

Cost accounting is rare. Information technology systems use computer-based programs are equally rare and planning severely hampered by the combined factors the dearth of market information and insecurity in securing reliable, affordable operating capital financing. In a similar vein, day-to-day operations, including inventory control, central temperature/atmospheric monitoring, are quite poor or even lacking.

Preventive maintenance is also a rarity, warehouse maintenance personnel are poorly trained for the new systems they are operating, and most newly constructed facilities rely upon initial warranty agreements. There are also very few trained refrigeration technicians in the country and very few refrigeration repair service enterprises. There is one reported Turkish firm, BRF, with service centers located in Baku and Ganja primarily supporting systems they have installed. Even in the West these are

not uncommon problems and can be overcome thru participation in targeted training programs and application of the lessons learned.

Physical construction of cold store facilities is also affected by the lack of expertise of Azerbaijan contractors in this field. Fortunately most the walls and overheads of most of the facilities recently constructed are of pre-made metal clad, insulated interlocking panels. These have proven particularly useful where cold storage warehouses have been installed in existing warehouses or other buildings. For the most part, most of the new facilities also have insulated refrigerated doors none have automatic, quick opening doors appropriate where forklifts and other powered materials handling equipment are used. Also, none of the facilities visited had modern loading docks equipped with self leveling ramps and integrated lighting and few had refrigerated staging areas.

Refrigeration equipment is representative of current technology and all new units examined use Freon refrigerants, most commonly R404A. Some facilities use R-22 (a refrigerant targeted for elimination due to environmental concerns) and this practice should be avoided or prohibited. None of the newer units use ammonia although it is certainly warranted as the equipment and operation of ammonia systems for larger facilities is considered to be much more economical than Freon systems. Again, this reluctance to employ ammonia systems may be a lingering artifact from Soviet times when such systems were notorious for leakage or may be the result of a lack of trained personnel to operate such systems. Regardless, the Freon based systems due the job, are compact and modular in design and relatively easy to maintain.

Floors, and the substrate beneath the floors, are critical to the construction, operation, and maintenance of refrigerated cold storage facilities, particularly those that are intended for frozen storage. Chilled storage rooms (for temperatures above 0^{o}C or 32^{o}F) were typically not equipped with integral drains. Vapor barriers, adequate drainage, and insulation panels were common though amongst recently constructed facilities intended for frozen storage, but in at least one case where the actual pouring of concrete for a new cold storage plant was observed, the contractor lacked basic expertise and understanding of specific reinforcement of floors. In this case, the concrete was poured upon a base of crushed rock overlaid with reinforcing wire screen mesh. The concrete was poured and screeded, but the wire mesh was not pulled into the middle of the slab but was left ineffectively laying on the surface of the gravel beneath the concrete. Obviously, reinforcing components are of no use unless they are located within the material they are to reinforce. The construction foreman was questioned regarding this very basic oversight, but responded that it was not necessary to pull the wire into the slab as anther floor deck would be laid upon this first slab; a very erroneous belief.

Additionally, **both farmers and cold chain operators are not familiar with many simple technical procedures**, including sorting, grading, packing, and packaging that add shelf life and perceived quality to fruits and vegetable as well more importantly result in a higher price. Most fruits and vegetables are packed in the field, or nearby, as “field run” in expensive wooden crates. Seldom is the produce size graded or sorted as to preferred quality characteristics. Accordingly, buyers tend to purchase the product at lower prices related to the lowest quality aspects of the produce or at best based upon an estimate of what the resultant quality mix will be when the product is sold. Regardless the end result is a lower price to the Azerbaijan farmers, traders and processors. Assistance in better grading of products could be an important area for PSCEP.

Packing remains another problem. Wooden crates are expensive and in short supply, much as a result on prohibitions against forest harvesting; while fiberboard packing materials must be imported or purchased from a limited number of suppliers in Baku. Several of the individuals interviewed not only cited this as a problem, but they were also looking for funding to build their own packing production plants. Another alternative gaining popularity is the use of injection molded, plastic packaging some of which is manufactured in Azerbaijan or available thru imports. Although several improvements in this area have been made in the past few years, there is much room for increased growth and much to be gained in the marketplace by having appropriate and attractive packaging materials. Fortunately, PSCEP anticipated this constraint and has made packaging materials one of its selected sub-sectors.

Only two of the operators interviewed even considered waxing the apples they packed; a practice that results in preserving original quality and increased shelf life. Others believed that this was a practice that contaminated the fruit, perhaps a perception carried over from Soviet times when petroleum products were occasionally used for this purpose. To the contrary, waxing is almost a universal process used in most developed countries and is accomplished using fully edible and safe vegetable waxes. Ironically, three of the individuals interviewed expressing this miss-conception acknowledged that imported waxed apples could be stored twice as long as domestic, un-waxed apples and brought on the average a price in the local markets double to three times that of the local apples.

In a similar vein, two of the packers in the Samkir/Ganja area were using metabisulphate pads in flats of grapes to preserve quality (an accepted "best" practice in the U.S. and the EU), while yet another firm in the area told the author that they would not use such a thing, inaccurately stating that it was "poisonous." Clearly there are many misconceptions about technologies that need to be dispelled.

Fiberboard pomegranate flats that could be improved by the addition of a plastic insert

Grapes ready for export with meta-bisulphate pads

Improperly stored persimmons in advanced stage of decay.

Although several of the packers had or intended to install controlled atmosphere storage, some also believed that this practice was harmful to the environment and detrimental to the safety of the fruit stored. It was also reported that one cold store warehouse had actually been warning farmers against selling or using the services of a local warehouse which had a modern CA facility. The rumor spread in the region was that this technique would result in poisoned fruit. Whether the individual concerned actually believed this or was simply trying to redirect produce to the two refrigerated warehouses he controlled is not known. Regardless, CA storage and related control of storage humidity are common and quite safe processes used throughout the world and are very effective at maintaining quality and extending the shelf life of many products. Unfortunately, Azerbaijan agricultural products of low quality end up in the domestic market continuing the perception that Azeri products are not as good as those that are imported.

Finally, **the agribusiness sector continues to experience significant, increased operating costs due to "indirect charges**," including the costs of monopolies, unofficial charges and payments, as well as other non-tariff barriers which are prevalent throughout the sector. Of particular adverse impact are those extracted by police upon smaller farmers and operators. An example of the impact of these practices on larger operators is an alternative shipping procedure used at the northern border of Azerbaijan near Guba where most of the surface transported fruit and vegetables cross into Russia. Shippers there have found it cheaper to truck their products to a point just south of the border where it is off-loaded and transferred to unrefrigerated railcars for a short trip across the border by rail where it is once again transloaded to trucks and truck trailer combinations for the continued journey to markets in Russia. The cost of this procedure is deemed to be much less than having to pay the bribes and delays incurred in transiting the border in the original conveyances. This practice not only results in unnecessary costs, but also physical damage and loss of quality to the product resulting from the increased handling of these perishable cargoes. Proposed automated customs clearing and anti-corruption activities are needed if this somewhat ignored, but very significant barrier is to be eliminated.

E3. Opportunities

Sector weaknesses are in many ways the mirror images of many significant opportunities within the Azerbaijan cold chain sector. There is a demonstrated need for new facilities with increased capacity and technology including controlled atmosphere storage; the establishment of domestic refrigerated transport providers; improved added value of existing products by the application of simple techniques such as grading, sorting, and improved packing; the development of additional value added products; all of which would result in higher net earnings to the industry as they have in most developing countries. There are also excellent opportunities for the development of markets other than those of Russia and the other CIS that would be significantly enhanced by the establishment recognized food protection and traceability programs by Azerbaijan distributors and producers as well as development of the regional East-West transportation network running thru Georgia to the Black Sea, gateways that can be used to expand Azerbaijan's existing markets in Europe.

Of particular interest is the apparent interest of US cold chain operators in the Azerbaijan market and in joint ventures, including U.S. companies operating refrigerated warehouses, providing transport refrigeration services, refrigerated equipment manufacturers, and refrigerated facilities construction companies. One US Company, Food Tech LLC is currently working in Azerbaijan providing engineering and construction supervision. The president and co-owner of Food Tech expressed to the author his belief that there were considerable opportunities for cold chain development in Azerbaijan and would appreciate any assistance that could be provided to work with Azerbaijan companies in this field. His firm provides engineering and construction management expertise and joins with local companies for actual construction of facilities. One Azerbaijan Company, A&A, interviewed has limited experience in cold chain facility construction but extensive experience locally and internationally in moderately sized construction projects. The Company Director stated that he was very interested in expanding his firms refrigerated warehouse construction activities and could be an excellent joint venture partner for Food Tech. Yet another Baku based firm, ASENA, was visited as part of the preparation of this report and has excellent fabrication capacity and could yet be another potential partner. Food Tech would appreciate

support in arranging meetings for them with appropriate firms in Azerbaijan. It is suggested that CIIC be included in any such meetings.

Also from the U.S. side, several attendees at the recent Global Cold Chain Alliance attended by the author (an alliance of the International Association of Refrigerated Warehouses, World Food Logistics Organization, the International Refrigerated Transportation Association, and the International Association for Cold Storage Construction), annual convention held this April in Palm Springs were approached regarding interest in potential joint ventures or other commercial activities in Azerbaijan. The president of Americold one of the largest if not the largest operator of refrigerated warehousing in the US expressed considerable interest in working with the Azerbaijan Cold Chain Sub-sector. Americold recently completed two facilities in China and entered into management agreements with others there as well. The firm is also currently in the process of evaluating a proposed facility to be located in Poti, Republic of Georgia and was quick to grasp the opportunities presented in Azerbaijan as well as the importance of the improved East/West highway system between Poti and Baku as well as the potential of the co-located rail system. Another participant in the conference, the president of Rail Logistics, LLC whose firm is located in Overland, Kansas and specializes in the rail transport of produce in the US including the operation of two unit trains that operate weekly, one from Washington State and the other from California, carrying refrigerated products to markets in Chicago and east was very interested in the potential of Azerbaijan for similar activities. One other firm, C.R. England, a major operator of a refrigerated transport fleet in the US also expressed interest in entering into a joint venture with an Azerbaijani company for the purpose of developing long haul refrigerated transport. CR England is already involved in a similar operation with 500 units in China and could be a good potential joint venture partner for MNR-Azerbaijan Fruit Company of Guba, the Director of which has expressed interest in developing an initial fleet of 50 units.

Several other firms expressed interest in working in or with Azeri enterprises as did the staff of the GCCA itself. All indicated that they would be willing to participate, at their expense, in a commercial visit to Azerbaijan. In addition, several other firms expressed considerable interest in hosting and/or supporting a visit of representatives from the Azerbaijan Cold Chain Sub-sector should a contingent of these individuals visit the United States.

The strategic location of Azerbaijan in Central Asia and its position as a rail hub with lines running East and West, across the Caspian) provides a unique opportunity to provide a viable alternate surface route for supplying Afghanistan.

From a general economic view, it should be noted that also at the recent annual convention of the GCCA the attending executives of the major private sector companies all agreed that their industry was economically strong and experiencing increased growth despite the current recession. In a discussion on "How the Economy is Changing Your Customer," the Director of Logistics for Butterball Turkey, VP of Logistics for ConAgra Foods, and Senior Director Transportation & Distribution for Schwan's stated that this was the result of increasing worldwide demand for improved food quality and a trend by major food producers and distributors to use public cold storage facilities rather than to invest in company owned facilities. The consensus was that this trend will continue in the forthcoming years and that the need for public cold storage warehouses will increase rather than diminish.

E4. Threats

Threats to the sector include a potential **devaluation of Azerbaijan Manat (AZN)**, especially as relates to industry stakeholders as borrowers, since some loans are tied to foreign currencies. This will increase the cost of imported inputs, equipment and materials, and is further enhanced by the ongoing devaluation of Russian and CIS currencies accompanying a deepening economic crisis in Russia and other CIS countries. Another potential and significant threat is the world-wide general reduction in world supply of investment capital and worsening of the regional economic downturn. Finally, an important threat is increased **government investment cold storage facilities that compete directly with those of the private sector, or the picking of "winners" in regions, without market considerations**. There is a strong role for government in providing the necessary infrastructure support and policy support for agri-business in general and cold chain operations in general. But government should support, not lead this process. The specter of unchecked corruption within Azerbaijan also poses a threat.

E5. Summary of Current Cold Chain Development

Table 2 below summarizes Azerbaijan's cold chain situation vis-à-vis modern cold chain operations in more developed economies.

Table 2: Comparison of Characteristics of "Developed" and Azerbaijan Cold Chain Elements

Element	Developed	Azerbaijan
Initial Cooling	Very common	Almost non-existent
Chilled Products	Good Temperature Control CA Common CH Common Waxing Common	Good Temperature Control CA Uncommon CH uncommon Waxing Common
Frozen Processing	Very common	Almost non-existent
Distribution Storage	Excellent temperature/ inventory control, and retrievable records	Good temperature control, very poor inventory control, and very poor records
Refrigerated Transport	Modern air, truck/trailer and railroad systems	Very limited capacity, virtually no refer fleets

SECTION IV

Action Plan

A. Introduction

PSCEP's strategy consists of a four pronged approach to enhance the sector competitiveness: (1) firm level assistance, especially of key "anchor" enterprises, focused on addressing key constraints to increasing sales, increasing investment, creating jobs, and enhancing productivity; (2) Regionally and nationally focused sector level assistance, especially select multi stakeholder training opportunities that address sector-wide issues and constraints; (3) Access to investment and finance, including sustainable commercial bank lending, equity investments, and joint venture and GDA promotion to address specific areas such as transportation logistics; (4) Development of associative relationships.

B. Strategy Pillars

B1. Enterprise Level Assistance

As Michael Porter asserts, "nations are not competitive, enterprises are." Paraphrasing somewhat, a "sector" can only become more competitive through the combined competitiveness of its individual enterprises, plus the synergies created through effective value chains. Accordingly, much of PSCEP's actions will be focused on delivering timely, effective, and highly focused technical assistance geared to addressing concrete firm needs, especially addressing the demands of current and potential customers. This assistance will be provided through world class international experts where necessary, as well through the BDS providers, who will be the beneficiaries of continual "on the job training" of international consultants. As part of this training, international assistance provided to these enterprises will be channeled through the BDS. The needs assessments conducted to date indicate needs in several key areas. PSCEP expects to provide direct support to no less than 20 enterprises and indirect support to multiples of this. These include:

a. Management. As noted in the assessment, many enterprises do not appear to have a full understanding of the fundamentals of managing a cold storage warehouse, their costs structures or profitability drivers. Similarly some enterprises have constructed some relatively large warehouses without sufficient demand analysis. Where this appears to be a constraint, PSCEP will work with management to address many of these issues, especially financial analysis needed to assess profitability drivers.

b. Technical Specifications. Technical assistance will be provided to client enterprises on an identified need basis. The assistance will cover subjects including Cold Storage Operations, Maintenance, Post Harvest Practices such as Grading, Sorting, Packing and Storage as well as on Transport Refrigeration and Cold Storage Construction.

c. Access to Finance. PSCEP and its BDS providers will help enterprises to assess their finance needs, include proper financial structure. We will work with these enterprises in preparing needed documentation for both debt and equity financing.

d. Sourcing. A major obstacle for numerous warehousing enterprises interviewed is adequate sourcing of products. One such warehouse in Samkir stated that he employs three buyers at a cost 25 AZN per day to go from farm to farm buying that day's available harvest at

each. PSCEP will provide assistance to selected warehouse/packers to establish more effective means of sourcing product including crop contracts, a cellular phone buying system, and other methods that may be termed relevant to the individual enterprise. This will include Islamic contracts recognizing Sharia where applicable.

e. Identifying new markets. To focus resources, PSCEP strategy is to keep assistance efforts focused, especially so that "lessons learned" from one enterprise or region can be utilized in others. At the same time, flexibility is also an important project tenet. Accordingly the list above is not exclusive. We will provide cost effective assistance as required by the enterprise and its customers. Examples of this include assistance already provided to MNR Azerbaijan Fruit Co of Guba when during the initial visit to their cold storage warehouse, the owner requested immediate assistance to save 10 tons of onions that had been stored under improper conditions and were decaying. He was promptly provided with information and guidance on properly storing this crop and thereby saved this investment. In another case, a "Summary of Controlled Atmosphere Requirements and Recommendations for 34 Harvested Vegetables" (see Attachment 5) was prepared and given to the operators of several of the cold storage facilities visited when they stated that they needed this information.

Finally, a spreadsheet template entitled "Computing Return on Investment and Comparison of Private Ownership vs. Use of a Public Facility" (Attachment 2) was prepared and provided to CIIC in response to a request by CIIC to assistance in evaluating requests for funding from companies within the cold chain sector. The template is also helpful to individuals currently operating such facilities or contemplating building them.

B2. Sector / Value Chain Level Assistance

B2a. Training in Azerbaijan

PSCEP will address regional and national level issues through a variety of means, especially training. Training, however, will be linked to ongoing transactions and enterprises level assistance, where representatives of multiple firms are brought together for these programs. PSCEP will develop a lean but effective training program for common constraints and issues impacting enterprises across the sector at both the regional and national levels. For example, in late July, PSCEP will hold three-day workshops in Ganja and Lankoran to address post harvest technology relevant to their respective crops, an area where the assessment has identified across-the-board sector constraints. In August, we will follow with a national level conference on the same topic to discuss experiences since the July conference. The initial training will include the following subjects:

- In-field and initial cooling
- Using cold chain services to increase net revenues
- Storing and Packing fruits and vegetables
- Chilled processing f fruits and vegetables
- Packaging
- Growing to contract
- Acquiring market information

A series of three-day courses directed specifically at individuals involved in the operation and maintenance of cold chain facilities will also be presented in late July/August and will include the following subjects:

- Cold Storage Warehouse Training for Management and Owners
- Cold Storage Warehouse Training for Maintenance Personnel
- Cold Storage Warehouse Training for Operations Personnel

Transport refrigeration will be the subject a workshop that will be held in September/October that will present subjects including that will include the subjects of Refrigerated Transport Basics, Fleet Operations, Contracting, Common Carriers, Containers, Railroad and Marine.

In September/October, a three day cold storage construction workshop will be held in Baku to present the basics of building modern cold storage facilities. Azerbaijani suppliers of insulated panels and purveyors of refrigerated equipment will participate in this workshop. The following subjects will be presented at the workshop:

- Business Planning and Financial Considerations
- Planning
- Sizing and Layout
- Insulation
- Foundations
- Refrigeration
- Heat Loads
- Machinery Options
- Sourcing Materials and Equipment

PSCEP will develop or secure handbooks for each training activity. Much material for these handbooks is available publicly and permission has been secured by PSCEP to copy and translate other material specifically for this project.

B2b. U.S. Study Tour

PSCEP will develop a guided visit of 15 Azerbaijan Cold Chain Sub-sector enterprises, including leasing and financing institutions, to US Cold Chain facilities in late September. At least one Azerbaijani trader who participated in a more general agriculture sector visit to the U.S. three years ago identified the importance of the cold chain and packing in successful produce operations there and returned to Azerbaijan where he formed the MNR-Azerbaijan Fruit Co. that now has four refrigerated warehouses, a packing service, and a box manufacturing factory. Several U.S. firms have stated that they are interested in supporting such a visit.

Azerbaijani participants will share in costs such as paying own travel expenses and those selected would be required to attend training sessions, prior to journey, designed to insure they make the most of the experience. Specific visits to firms in the U.S. would be matched to the participant's individual needs and interests. The establishment of business relationships and joint ventures with the firms visited would be encouraged and supported as may be appropriate.

Participation of U.S. companies will be secured prior to the visit with an eye toward the potential for some supporting funding, specifically toward Carrier (United Technologies), Thermo King (Ingersoll Rand), and Tree Top; the latter a fruit cooperative in Washington State. The following is a proposed itinerary with participating firms for such a visit:

- Washington State
    - Seattle: Visits to include Seattle Cold Storage, Burlington Northern Fruit Express, Safeway Northwest Distribution
    - Wenatchee (major fruit growing area): Visits include Stemilt Fruit Growers Association (supplier to Azeri markets), and Washington State university Tree Fruit Research Center
    - Yakima/Selah (fruit and vegetables): Visits include Longview Fiber and Box Plant, Tree Top (1,750 member growers association), Controlled Atmosphere Storage, ATAGO USA, CCS Equipment, Inc.
- California
    - Fresno or Imperial Valley
    - University of California-Davis Post-Harvest Extension Service
    - Visits in these areas to include hydro-cooling, in-field packing (grapes, melons, peppers), packing houses, lettuce, greens, and salad packing, and alternative energy sites.

B2c. Communications and Outreach

PSCEP will support an active communications and outreach program, targeting leading stakeholders in the sector. The program will consist of providing technical information, sector developments, and other news that conveys important sector issues. Initially this may be done through the PSCEP project website (to be developed in July), e-mail blasts, and inclusion of technical articles in leading national publications and newspapers. This effort will be closely linked to PSCEP's objectives of developing associative relationships in the sector, as discussed below.

PSCEP will publish a "Directory of Cold Chain Facilities/Services" in July to disseminate the information it collects on the location and capabilities of individual cold chain service providers in Azerbaijan who wish this information to be made public. This information will enable more producers, processors, traders, etc. to become familiar with the availability of cold storage facilities in the country. The initial publication will be both in hard copy and web based. This directory should become a self supporting document and could well be the foundation around which a Cold Chain Sub-sector Association could crystallize.

In time, and no later than the second quarter of 2010, these efforts should be handed over to an industry group, association, or some other sector stakeholder.

B3. Access to Finance / Joint Ventures

Commercial bank and equity investments. While PSCEP will work at the enterprise level to enhance access to finance, it will also work at a more concerted, macro level to achieve this objective. For example, PSCEP will work with the six commercial banks with which it has signed MOUs, the AIC, the CIIC, and the KAIC in their better understanding of the cold chain sector and its opportunities. In July, for example, PSCEP will hold separate presentations for the commercial banks, the equity funds, as well as IFIs such as the EBRD and IFC, on this Action Plan, and, especially, on investment opportunities in the sector. Meetings with the funds will be held in June, those with the banks in July and with the IFIs in August.

Joint Ventures/Transportation and Logistics Sector. As previously stated, there are several US companies involved in providing cold chain services that have stated they would travel to Azerbaijan at their own

expense for the purpose of looking for joint ventures or opportunities to participate in the refrigerated transportation and logistics sector. PSCEP will facilitate the visit by these firms and introduce them to potential partners and customers in Azerbaijan. At the firm level and through these larger joint ventures, PSCEP aims to generate no less than $15 million in the next two quarters.

B4. Forging Associative Relationships

Building Social Capital. There is currently little cooperation and limited interaction among the gamut of the many stakeholders that are part of the cold chain sector. Competitiveness theory – and practice worldwide – indicates that this needs to be corrected as the sector develops. PSCEP's ultimate objective is to catalyze the formation of regional clusters and a national association to provide a forum and mechanism for firms to address common issues and constraints. Lessons learned world-wide suggest, however, that these efforts must be bottom-up to be successful. Clusters, associations, or other organizations imposed and/organized from the top typically fail, as there is no buy-in and, especially, trust or "social capital" among stakeholders to make the organizations sustainable. Accordingly, PSCEP will help generate a continuous stream of small steps from components two and three above, that will create a foundation for the establishment of formal clusters or associations by Year 2 and, certainly, by Year 3 of the project. Examples include the regional and national trainings, development of information and communications mechanisms generate increased interests in what others are doing in the sector, increased understanding by sources of capital (banks, investment companies) in the sector, etc.

Expanding Stakeholders, Including Public-Private Partnerships. PSCEP will build associative relationships by expanding dialogue between and the participation of new stakeholders. An example we will assist Ganja Agriculture University to develop curricula and training materials for courses related to the cold chain, especially refrigeration. PSCEP will also invite local technical institutes and the university to participate in the delivery of the aforementioned training where appropriate and will provide lectures to the students of these institutions on these subjects. Finally, PSCEP will link Ganja Agricultural University faculty with their counterparts at Washington State University for the purpose of establishing a sustainable relationship in the areas of post harvest handling and refrigeration.

C. Expected Impact

Expected results from PSCEP's efforts through this Action Plan include:

- Over 15-20 enterprises directly assisted, increase sales and employment by 50% over the industry trend line.
- Over 100 individuals trained in cold storage operations and maintenance, including at least five regional and national workshops.
- Enhanced access to finance to these enterprises, exceeding US$30 million.
- At least two joint ventures secured with international investors which in addition to investment capital, provide technology transfer to the sector.
- Establishment of associative relationships such as regional and/or national associations or other forms of associative relationships.

Beyond these more quantifiable indicators, the cold chain sector by September 2011 will be more structured and cohesive, with a significantly larger percentage of fruit and vegetable value chains having a stronger cold chain segment increasing productivity and value. Farmer/producer awareness of the importance of cold chain will be significantly higher, through PSCEP linkages with universities, and an

effective communications program. In the course of the next six months (December 2009), PSCEP will work to establish benchmarks for each of these indicators.

SECTION V: ATTACHMENTS

Attachment 1: Directory of Warehousing and Cold Storage Companies

Name	Location	Facility Type	Size (MT)	Name
Abseron Cartage	Baku	Distribution CS	1500	Abseron Cartage
Agosevis G Z	Kirdalan	CS & Pack	2X500	Agosevis G Z
Agro Servise	Baku	CS & Pack	500	Agro Servise
Aydin	Baku	CS & Pack	500	Aydin
Bak Fem	Baku	CS & Pack	4000	Bak Fem
Balacans	Balacan	CS, Juice, Bottler	2500	Balacans
Balaken Konserv	Balaken	CS & Pack	2500	Balaken Konserv
Baxtiyar	Guba	CS & Pack	500	Baxtiyar
Elvin 2	Jalilabad	CS & Pack	1 x 60, 1 x 40	Elvin 2
Fizuli Ahmedov	Ganja	CS & Pack	1000	Fizuli Ahmedov
MNR Azerbaijan Fruit	Guba	CS & Pack	1200	MNR Azerbaijan Fruit Co
Ilma	Baku	CS Distribution	3000	Ilma
Ikar MMC	Guba	CS & Pack	500	Ikar MMC
Ikar Soyuducu" MMC	Guba	CS & Pack	500	Ikar Soyuducu" MMC
Lankoran Juice &Fish	Lankoran	CS & Pack	750	Lankoran Juice and Fish
Mammadov Ilgar		CS & Pack	2000	Mammadov Ilgar
NAA	Ganja	CS & Pack	30 x 750	NAA
NJT	Salyan	CS, Dist, Pack	Under construction	NJT
Shakin Yunisav	Samkir	CS & Pack	1500	Shakin Yunisav
UNAgro MMC	Guba	2 CS Warehouses	1x 1000, 1x 2000	UNAgro MMC
Universal NAA	Samuk	CS & Pack	20000	Universal NAA
Vugar	Samkir	CS & Pack	2000	Vugar
Xirdala n MM	Baku	CS Distribution		Xirdala n MM
Zagatala Cold Storage		CS Distribution	500	Zagatala Cold Storage

Attachment 2: Computing Return on Investment and Comparison of Private Ownership versus Use of a Public Facility

NOTE: See Accompanying Notes

1. ANNUAL COST OF USING PUBLIC REFRIGERATED WAREHOUSE:

a. Annual fee to use public refrigerated warehouse.	$		
(This estimate should be obtained from a local public warehouse.)			
b. Transportation costs			
Total - Public Refrigerated Warehouse			-

2. TOTAL ANNUAL OPERATING EXPENSE OF COMPANY (PRIVATE) WAREHOUSE	
3. DIFFERENCE - Estimated net increase (decrease) in pre-tax cash outflows	-
4. TOTAL INVESTMENT	

5. RETURN ON INVESTMENT (BEFORE TAX)

= Difference in Cost (Line 3) / Total Investment (Line 4) x 100 = #DIV/0! %

6. RETURN ON INVESTMENT (AFTER TAX)

May be roughly approximated by reducing the percentage calculated on line 5 above by the composite of your applied tax rates

Conclusion: If the result of line 3 is less than zero, the public warehouse option would appear to be more attractive, even before consideration of ROI. Compare the ROI calculated above to the ROI your company generally achieves, or to returns available to other investment options.

Calculation of Net Present Value of Cash Flows

1. Number of years to calculate analysis	=		Years
2. Required rate of return	=		

3. Relevant annual cash flows		Private	Public
a. Year 1 - Capital expenditures	$		0
b. Annual operating expenses-net of tax	$		

4. Results:	Year #	Private	Public
	Initial Capital Expenditure	-	0
	1	-	-
	2	-	-
	3	-	-
	4	-	-
	5	-	-
	6	-	-
	7	-	-
	8	-	-
	9	-	-
	10	-	-
	11	-	-
	12	-	-
	13	-	-
	14	-	-
	15	-	-
	16	-	-
	17	-	-
	18	-	-
	19	-	-
	20	-	-
	Total NPV Cost	-	-

Schedule A

Investment Costs - Cold Storage Warehouse

Identify Units: USD, Manat, Other

INVESTMENT

1. Land: Include land clearing and building demolition costs. Land costs should be considered in analysis even if already owned.

Market value of land to be purchased:

Hectares or square Meters _____		
Firm bid, or $_____ per Hectares or square Meter	$	
Acquisition and related costs (if purchased)		
Total Land Cost		$

2. Building

Shell construction, including engine room and maintenance area, inspection rooms, battery charging area, offices, etc.	$	
Refrigeration equipment		
Monitoring and Recording equipment		
Insulation, including floor		
Sprinkler systems		
Electrical systems		
Standby Electrical Generation systems		
Architectural/design fees		
Land survey fees		
Environmental compliance		
Soil testing fees		
Grading and fill		
Site preparation (pilings, etc)		
Installation of access roads, rail sidings, etc.		
Parking lot paving		
Water supply - connections, wells, storage tanks, etc.		
Power supply to property		
Loading docks, enclosed/open, refrigerated/unrefrigerated		
Dock seals		
Dock levelers		
Underfloor heating system		
Rack system		
Office finishing (excluding furniture)		
Freezer and escape doors		
Outdoor storage facilities (e.g. for stacking aids)		
Interest during construction		
Transaction costs (attorney fees, survey, environmental survey, title insurance, transfer taxes and recording fees)		
Total Estimated Building Cost		-
Add contingency		
Total Building Cost		$ -

3. Warehouse Equipment:

	Forklifts, forklift parts and batteries, modified to work in freezer	$	
	Battery chargers, installed		
	Battery exchange equipment		
	Pallet Jacks & Other Handling Equipment		
	Conveyors		
	Racks and bins, installed		
	Pallets		
	Safety, security and sanitation systems		
	Hand trucks and other equipment		
	Stretchwrap equipment		
	Freezer clothes, rope, tape, miscellaneous		
Total Warehouse Equipment Cost	Inspection room equipment		
			$

4. Office Equipment:

		$	
	Furniture and accessories		
	Computer equipment		
Total Office Equipment Cost	Telephone and facsimile equipment		
			$

5. Transportation Equipment:

*		
		$
	Equipment to convey items to and from the warehouse	

6. Other (Please Describe)

$

7. TOTAL INVESTMENT

$

Schedule B

Operating Expenses - Cold Storage Warehouse

Identify Units: USD, Manat, Other

OPERATING EXPENSES

1. Payroll-Plant

Administrative - Warehouse (manager and plant supervision)	$	
Administrative - Warehouse (general office, clerical)		
Handling labor		
Engineering and maintenance		
Compliance and safety		
Extra labor provided - overtime, contract, seasonal		
Engine room & refrigeration systems		

Total payroll $ _____

2. Payroll Taxes, Insurance, Fringes

Payroll taxes	$	
Insurance - hospitalization, life, etc.		
Other employee benefits		
Insurance - Workmen's Compensation		
Pension and profit sharing		

Total payroll taxes, insurance $ _____

3. Plant Utilities

Light, heat and electric power	$	
Standby electric power generation		
Water		
Miscellaneous utilities		

Total utilities $ _____

4. Maintenance

Maintenance (including outside contractors and supplies)	$	
Plant		
Engine room & refrigeration system		
Handling equipment		

Total maintenance & supplies $ _____

5. Other Expenses - Plant

Safety and hazmat compliance	$	
Equipment rentals		
Loss and damage		
Plant supplies		
Security		
Sanitation		

	Miscellaneous-(identify amounts greater than $1,000):			
	a. Pallets			
	b. Transportation			
Total other plant expenses			$	
6. Administrative Expenses		a. Corporate Allocation		b. Plant
	Administrative salaries - (Corporate officers, directors, sales, other)	$ -	$	-
	Fringe benefits for administrative salaries	-		-
	Travel, entertainment & auto	-		-
	Telephone and fax	-		-
	Management Information Systems	-		-
	Donations and contributions	-		-
	Dues, fees, and subscriptions	-		-
	Advertising and public relations	-		-
	Other selling expenses	-		-
	Maintenance and repair - office	-		-
	Office supplies, forms, software, postage etc.	-		-
	Professional - legal, auditing and consulting	-		-
	Provision for bad debts	-		-
	Taxes, sales & use	-		-
	Miscellaneous administrative expenses			
	a. License and permits	-		-
Total administrative expenses		-		-
Grand total			$	-
7. Property Taxes and Insurance				
	Taxes - property and real estate	$		
	Insurance - property, machinery & liability			
Total property taxes & insurance			$	-
8. Total Operating Expense before Depreciation and Interest			$	-
9. Interest		$ -		
10. Add Back Depreciation	Depreciation	$		
12. **NET CASH FLOWS FROM OPERATIONS**	**Total Operating Expense**		$	-

Schedule C

Operating Income (Loss) - Cold Storage Warehouse

Identify Units: USD, Manat, Other

OPERATING REVENUES:		
1. Public Cold Storage Fees		
Monthly storage fees		
Inspection (In-Out) Fees		
Loading fees		
Inventory Confirmation Fees		
Documentation Preparation Fees		
2. Packing Fees		
Packing Services		
Packaging Sales		
3. Processing Fees		
Product Freezing		
Other Processing		
4. Other Revenues		
Total Gross Revenues		$
Less Cost of Goods Sold		
Net Gross Revenues		$
OPERATING EXPENSES		
1. Payroll-Plant		
Administrative - Warehouse (manager& plant supervision)	$	
Administrative - Warehouse (general office, clerical)		
Handling labor		
Engineering and maintenance		
Compliance and safety		
Extra labor provided - overtime, contract, seasonal		
Engine room & refrigeration systems		
Total payroll		$
2. Payroll Taxes, Insurance, Fringes		
Payroll taxes	$	
Insurance - hospitalization, life, etc.		
Other employee benefits		
Insurance - Workmen's Compensation		

Pension and profit sharing		
Total payroll taxes, insurance		$

3. Plant Utilities

Light, heat and electric power	$	
Standby electric power generation		
Water		
Miscellaneous utilities		
Total utilities		$

4. Maintenance

Maintenance	$	
Plant		
Engine room & refrigeration system		
Handling equipment		
Total maintenance & supplies		$

5. Other Expenses - Plant

Safety and hazmat compliance	$	
Equipment rentals		
Loss and damage		
Plant supplies		
Security		
Sanitation		
Miscellaneous-(amounts greater than $1,000):		
a. Pallets		
b. Transportation		
Total other plant expenses		$

6. Administrative Expenses		a. Corporate Allocation		b. Plant
Administrative salaries	$	-	$	-
Depreciation		-		-
Fringe benefits for administrative salaries		-		-
Travel, entertainment & auto		-		-
Telephone and fax		-		-
Management Information Systems		-		-
Donations and contributions		-		-
Dues, fees, and subscriptions		-		-
Advertising and public relations		-		-
Other selling expenses		-		-
Maintenance and repair - office		-		-
Office supplies, forms, software, etc.		-		-

Postage		-		-
Professional - legal, auditing and consulting		-		-
Provision for bad debts		-		-
Taxes, sales & use		-		-
Miscellaneous administrative expenses				
a. License and permits		-		-
b. Indirect expenses		-		-
Total administrative expenses		-		-
Grand total		-		
	$			
7. Property Taxes and Insurance				
Taxes - property and real estate	$			
Insurance - property, machinery & liability				
Total property taxes & insurance				-
			$	
8. Total Operating Expense before Depreciation and Interest				-
			$	
9. Net Income before Interest				-
			$	
10. Less Interest	$	-		
11. Add Back Depreciation	$			
12. **NET CASH FLOWS FROM OPERATIONS**				-
			$	

Attachment 3: Schedule with Benchmarks for Activities

Project	July	Aug	Sept	Oct	Days
Training and Workshops					
Post Harvest Workshop					
Preparation					10
Handbook Preparation					10
Presentation					9
CS Warehouse Training					
Preparation					9
Handbook Preparation					9
Presentation					
Management and Owners					2
Maintenance Personnel					3
Operations Personnel					3
Transport Refrigeration					
Preparation					6
Handbook Preparation					6
Presentation					2
Cold Storage Construction					
Preparation					5
Handbook Preparation					5
Presentation					2.5
Other Activities					
U.S. Visit					
Notification of Opportunity					2
Selection of Participants					4
Training of Paticipants					4
Agreements and Logistics					10
Project Execution					15
Directory					
Data Collection					15
Initial Dissemination					2
Sponsor Selection					5
Data Transfer					1
US JV Visit to Azerbaijan					
Notification of Opportunity					2
Pairing of Participants					5
Agreements and Logistics					10
Project Execution					7
Followup in US					7

Project	July	Aug	Sept	Oct	Days
Training and Workshops					
Post Harvest Workshop					
Preparation					10
Handbook Preparation					10
Presentation					9
CS Warehouse Training					
Preparation					9
Handbook Preparation					9
Presentation					
Management and Owners					2
Maintenance Personnel					3
Operations Personnel					3
Transport Refrigeration					
Preparation					6
Handbook Preparation					6
Presentation					2
Cold Storage Construction					
Preparation					5
Handbook Preparation					5
Presentation					2.5
Other Activities					
U.S. Visit					
Notification of Opportunity					2
Selection of Participants					4
Training of Paticipants					4
Agreements and Logistics					10
Project Execution					15
Directory					
Data Collection					15
Initial Dissemination					2
Sponsor Selection					5
Data Transfer					1
US JV Visit to Azerbaijan					
Notification of Opportunity					2
Pairing of Participants					5
Agreements and Logistics					10
Project Execution					7
Followup in US					7

Attachment 4: Cold Chain Components

Cold Chain Components: Any food begins to deteriorate or lose quality upon harvest whether it is meat, poultry, seafood, dairy, fruit or vegetable. Removing the initial heat from these products and maintaining product temperature by chilling, controlled atmosphere (CA) storage or freezing reduces the rate of deterioration and extends the shelf-life of the product. Shelf life being defined as the period during which the product may be held or stored prior to consumption and during which it retains acceptable attributes such as "freshness", wholesomeness, flavor, color, taste, palatability, etc. In addition to protecting quality, postharvest chilling, CA storage, or freezing also provides flexibility by making it possible to market products at the optimum time.

The term "cold chain" and the components thereof, refer to steps from harvest to consumption that extends the natural shelf life of a product. Typical components of a cold chain may include post-harvest handling, refrigerated transport, refrigerated storage, controlled atmosphere storage, chilled or frozen processing, cold storage holding and/or distribution, retail refrigeration, institutional refrigeration, and home refrigeration.

Post Harvest Handling: The internal heat of seafood, meat, poultry and milk must be removed immediately upon harvest if the quality of these products is to be maintained. Most fresh fruits and vegetables also require thorough cooling immediately after harvest in order to deliver the highest quality product to the consumer. Producing consistently high-quality products and the ability to ensure that quality is maintained until the product reaches the consumer commands buyer attention and gives the grower a competitive edge.

Postharvest cooling rapidly removes field heat from freshly harvested commodities before shipment, storage, or processing and is essential for many perishable crops. Proper postharvest cooling can:

- Suppress enzymatic degradation and respiratory activity (softening)
- Slow or inhibit water loss (wilting)
- Slow or inhibit the growth of decay-producing microorganisms (molds and bacteria)
- Reduce production of ethylene (a ripening agent) or minimize the product's reaction to ethylene.

Being able to cool and store produce eliminates the need to market immediately after harvest, which can be an advantage for high-volume growers as well as farmers who wish to supply restaurants, bazaars, and other food markets. To select the best cooling method, it is necessary to understand the basic principles of cooling. The choice of cooling method depends on the following factors.

As proper cooling delays the inevitable quality decline of produce and lengthens its shelf life; most wholesale buyers in developed economies now require that fresh produce items be properly and thoroughly cooled before they are shipped to market. The simplest way to reduce the loss of quality for fruits and vegetables is to harvest it during the coolest parts of the day and to keep it in the shade away from direct sun-light. In extremely hot weather, many growers have found that harvesting at night, reduces the amount of mechanical cooling needed. In many areas of the world where mechanical refrigeration is limited, animals are also harvested at night so that their primary heat is removed thru the night's lower ambient temperatures.

Initial cooling of products should be as close to the point of harvest as possible. The choice of cooling method depends on the following factors:

- **The nature of the product**. Different types of produce have different cooling requirements. For example, strawberries and broccoli require near-freezing temperatures, whereas summer squash or

tomatoes would be damaged by such low temperatures. Likewise, because of problems that can be caused by wetting of certain products, hydrocooling or icing may not be appropriate.

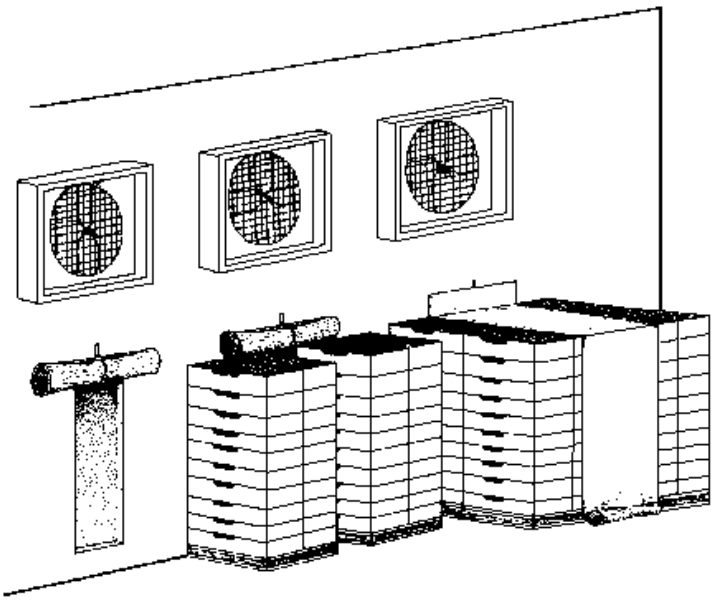
- **Product packaging requirements**. The best choice of cooling method may depend on whether the produce is in a box, bin, or bag. The package design can have an effect on the method, rate and cost of cooling.
- **Product flow capacity**. Some methods of cooling are much faster than others. If the volume of produce to be cooled per season, per day, or per hour is large, it may be necessary to use a faster cooling method than would be used for lower volumes.
- **Economic constraints**. Construction and operating costs vary among cooling methods. The expense of cooling must be justified by higher selling prices and other economic benefits. In some cases--for example, when the volume of produce is low--the more expensive methods cannot be made to pay for themselves.

There are several common methods available for the initial cooling of produce. **Evaporative cooling** is an effective and inexpensive means of providing a lower temperature atmosphere with high relative humidity for cooling produce. It is accomplished by misting or wetting the produce in the presence of a stream of dry air. Evaporative cooling works best when the relative humidity of the air is below 65 percent. At best, however, it reduces the temperature of the produce only 10 to 15 ^{o}F and does not provide consistent and thorough cooling.

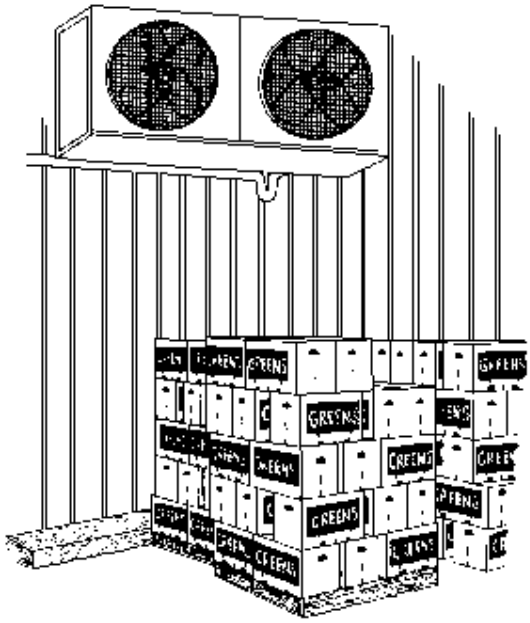
Icing: This may involve the simple addition of ice or ice packs to the product. Top or liquid icing may be also be used on a variety of commodities. In the top icing process, crushed ice is added to the container over the top of the produce by hand or machine. For liquid icing, a slurry of water and ice is injected into produce packages through vents or handholds often without the need for depalletizing the packages or removing their tops. Icing is particularly effective on dense packages that cannot be cooled with forced air. Because the ice has a residual effect, this method works well with commodities that have a high respiration rate, such as sweet corn and broccoli. Icing is relatively energy efficient. One pound of ice will cool about 3 pounds of produce from 85 to 40 ^{o}F.

Forced-air cooling can be used effectively on most packaged produce. To increase the cooling rate, additional fans are used to pull cool air through the packages of produce. Although the cooling rate depends on the air temperature and the rate of airflow through the packages, this method is usually 75 to 90 percent faster than room cooling. Forced-air cooling can also be very energy efficient and is an effective way to increase the heat removal rate of a cooling room.

Room cooling is simply a matter of placing produce in an insulated room equipped with refrigeration units, to chill the air. It may be used with most commodities but may be too slow for some that require quick cooling. It is most effective for storing pre-cooled produce but in some cases cannot remove field heat rapidly enough. Carefully directing the output of the cooling system evaporator fans can significantly improve the cooling rate. Properly designed, a room cooling system can be relatively energy efficient.



Forced-air Cooling



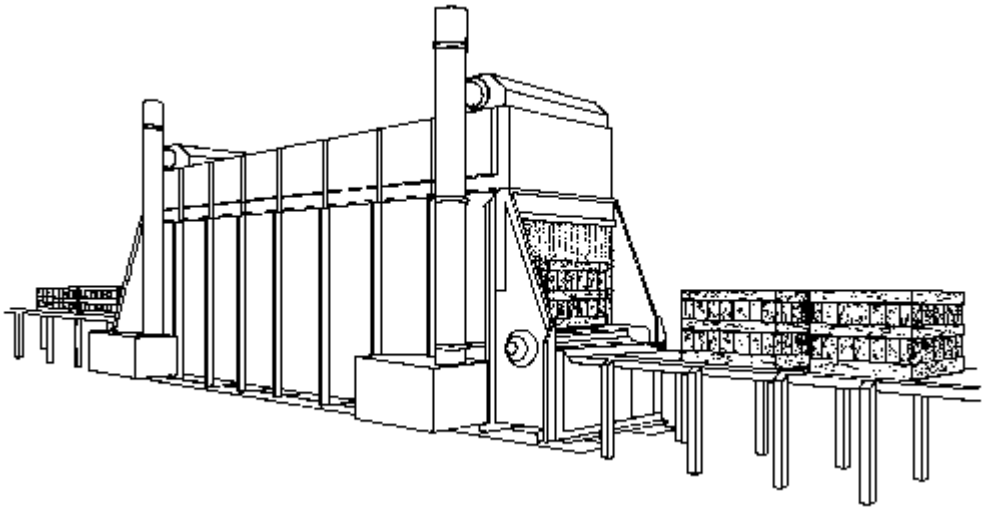
Room Cooling

Hydrocooling can be used on most commodities that are not sensitive to wetting. (Wetting often encourages the growth of microorganisms.) In this process, chilled water flows over the produce, rapidly removing heat. At typical flow rates and temperature differences, water removes heat about 15 times faster than air. However, hydrocooling is only about 20 to 40 percent energy efficient, as compared to 70 or 80 percent for room and forced-air cooling.

Hydrocooling is a common procedure wherein freshly harvested produce is cooled directly by chilled water. Hydrocooling is a fast and effective way to cool produce and with modern technology, hydrocooling has now become a convenient method of postharvest cooling on a large scale.

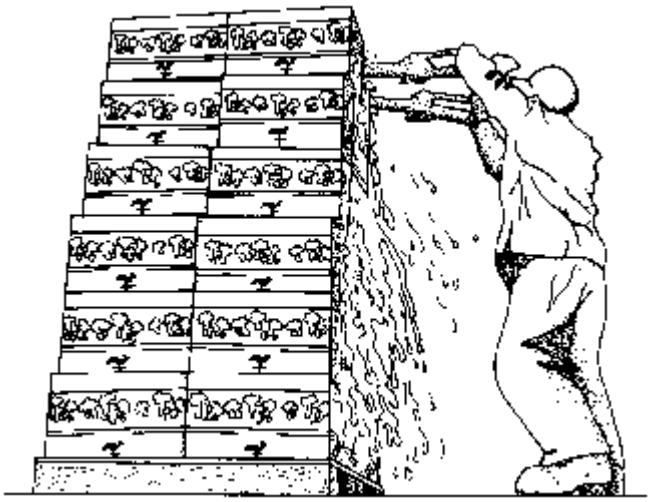
Many types of produce respond well to hydrocooling. Produce items that have a large volume in relationship to their surface area (such as sweet corn, apples, cantaloupes, and peaches) and that are difficult to cool can be quickly and effectively hydrocooled. Unlike air cooling, no water is removed from the produce. In fact, slightly wilted produce may sometimes be revived by hydrocooling.

1. Transport to Packing House/Cold Storage
2. Freezing/Processing
3. Cold Storage
    a. May be preceded by drying or other conditioning
    b. Controlled Atmosphere (CA)



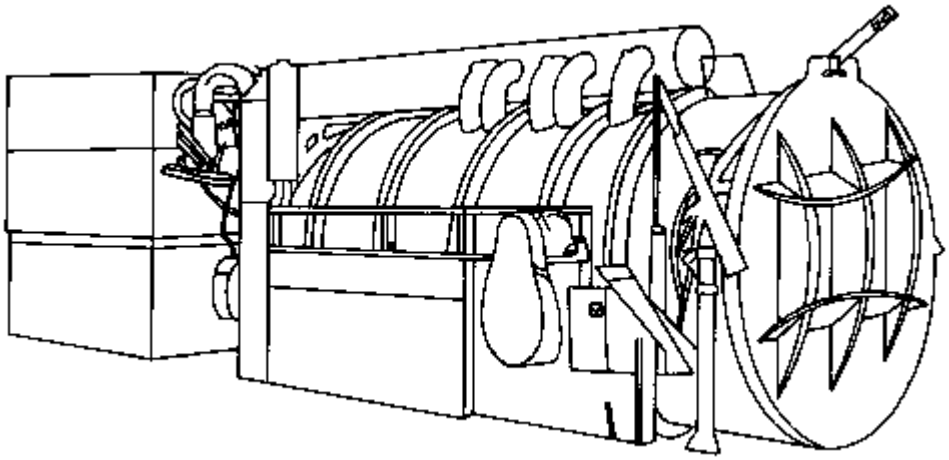
Top or liquid icing may be used on a variety of commodities. In the top icing process, crushed ice is added to the container over the top of the produce by hand or machine. For liquid icing, a slurry of water and ice is injected into produce packages through vents or handholds (*below*) without depalletizing the packages or removing their tops.

Icing is particularly effective on dense packages that cannot be cooled with forced air. Because the ice has a residual effect, this method works well with commodities that have a high respiration rate, such as sweet corn and broccoli. Icing is relatively energy efficient. One pound of ice will cool about 3 pounds of produce from 85 to 40 F. For more information refer to Agricultural Extension Publication AG-414-5,



Maintaining the Quality of North Carolina Fresh Produce: Top and Liquid Ice Cooling.

Vacuum cooling is effective on products that have a high ratio of surface area to volume, such as leafy greens and lettuce that would be very difficult to cool with forced air or hydrocooling. The produce is placed inside a large metal cylinder (*below*) and much of the air is evacuated. The vacuum causes water to evaporate rapidly from the surface of the produce, lowering its temperature. The process may cause wilting from water loss if overdone. Vacuum coolers can be energy efficient but are expensive to purchase and operate. They have only limited application to most common types of North Carolina produce.



A Bit about Washington Apples

Eating crisp, juicy Washington apples year-round is possible due to controlled atmosphere storage. Known simply as "CA" in the industry, controlled atmosphere storage involves careful control of temperature, oxygen, carbon dioxide and humidity.

CA storage got its start in England before World War II when farmers discovered their produce kept longer if stored in an airtight room. It was up to scientists to unravel the reasons for longer storage. Apples take in oxygen and give off carbon dioxide as starches in the flesh change to sugar. In the sealed rooms, this respiratory process reduced the oxygen, thus slowing the ripening process.

CA storage has come a long way since then, and researchers in Washington State have been among the leaders in this technology. CA was first used in the United States in the 1960s and Washington now has the largest capacity of CA storage of any growing region in the world.

The large, airtight CA rooms vary in size from 10,000 boxes to 100,000 boxes, depending on the volume of apples produced by the apple shipper and his marketing strategies.

CA storage is a non-chemical process. Oxygen levels in the sealed rooms are reduced, usually by the infusion of nitrogen gas, from the approximate 21 percent in the air we breathe to 1 percent or 2 percent. Temperatures are kept at a constant 32 to 36 degrees Fahrenheit. Humidity is maintained at 95 percent and carbon dioxide levels are also controlled. Exact conditions in the rooms are set according to the apple variety. Researchers develop specific regimens for each variety to achieve the best quality. Computers help keep conditions constant.

Timing of harvest is critical to good storage results. Apples picked too early will not store well in CA nor will those that are past the proper maturity.

In mid-August, apple growers start testing the maturity of their apples to accurately predict when to harvest their crop to put in CA rooms so the apples are mature, but not too ripe. Firmness, skin color, seed color, sugar level and flesh chlorophyll are tested.

When the proper growing and harvesting techniques are used, many varieties of apples can store for 12 months or longer in CA. Most of these apples are shipped to market between January and September. Regular refrigerated storage is used for much of the fruit marketed in the fall and early winter months. The CA rooms and CA operators are licensed and certified by the Washington State Department of Agriculture.

Washington law places requirements on the length of time apples must remain in CA conditions to qualify as CA-certified. Then state inspectors check every lot of fruit as the lot comes off the packing line to make sure the apples meet maturity requirements, the same requirements the U.S. Department of Agriculture uses for apples being exported. Only then will the box be stamped with the warehouse number and the "CA" symbol.
Apples meeting these standards must be shipped within two weeks or be reinspected to meet the same requirements. If they don’t pass, the shipper must remove the CA designation from the box.
Red and Golden Delicious apples must also meet Washington State’s strict standards for firmness and appearance. These standards apply to all apples shipped under Washington Fancy and Extra Fancy grades. Washington has the highest concentration of CA storage of any growing region in the world. Eastern Washington, where most of Washington’s apples are grown, has enough warehouse storage for 181 million boxes of fruit, according to a report done in 1997 by managers for the Washington State Department of Agriculture Plant Services Division. The storage capacity study shows that 67 percent of that space, enough for 121,008,000 boxes of apples, is CA storage.

Attachment 5: A Summary of Controlled Atmosphere Requirements and Recommendations for 34 Harvested Vegetables

	Temperature °C[1]		Atmosphere[2]		
Vegetable[3]	Optimum	Range	%O_2	%CO_2	Application[4]
* Artichokes	0	0 - 5	2 - 3	2 - 3	++
* Asparagus	2	1 - 5	Air	10 -14	+++
* Beans, green snap	8	5 - 10	1 - 3	3 - 7	+
processing	8	5 - 10	8 - 10	20 - 30	++
* Broccoli	0	0 - 5	1 - 2	5 - 10	+++
* Brussels sprouts	0	0 - 5	1 - 2	5 - 7	+
* Cabbage	0	0 - 5	2 - 3	3 - 6	+++
Chinese cabbage	0	0 - 5	1 - 2	0 - 5	+
* Cantaloupes	3	2 - 7	3 - 5	10 – 20	++
* Cauliflower	0	0 - 5	2 - 3	3 - 4	+
Celeriac	0	0 - 5	2 - 4	2 - 3	+
* Celery	0	0 - 5	1 - 4	3 - 5	+
* Cucumbers, fresh	12	8 - 12	1 - 4	0	+
pickling	4	1 - 4	3 - 5	3 - 5	+
Herbs[5]	1	0 - 5	5 -10	4 - 6	++
Leeks	0	0 - 5	1 - 2	2 - 5	+
* Lettuce (crisphead)	0	0 - 5	1 - 3	0	++
cut or shredded	0	0 - 5	1 - 5	5 - 20	+++
Lettuce (leaf)	0	0 - 5	1 - 3	0	++
* Mushrooms	0	0 - 5	3 - 21	5 – 15	++
Okra	10	7 - 12	Air	4 - 10	+
* Onions (bulb)	0	0 - 5	1 - 2	0 - 10	+
Onions (bunching)	0	0 - 5	2 - 3	0 - 5	+
Parsley	0	0 - 5	8 -10	8 -10	+
* Pepper (bell)	8	5 - 12	2 - 5	2 - 5	+
* Pepper (chili)	8	5 - 12	3 - 5	0 - 5	+
processing	5	5 - 10	3 - 5	10 - 20	++
Radish (topped)	0	0 - 5	1 - 2	2 - 3	+
Spinach	0	0 - 5	7 - 10	5 - 10	+
Sugar peas	0	0 - 10	2 - 3	2 - 3	+
* Sweet corn	0	0 - 5	2 - 4	5 - 10	+
* Tomatoes (green)	12	12-20	3 - 5	2 - 3	+
* Tomatoes ripe	10	10 -15	3 - 5	3 - 5	++
Witloof chicory	0	0 - 5	3 - 4	4 - 5	+

[1] Optimum and range of usual and/or recommended temperatures. A relative humidity of 90% to 95% is usually recommended (except for bulb onions).
[2] Specific CA recommendations depend on cultivar, temperature, and duration of storage.
[3] Vegetables proceeded by an asterisk (*) have expanded descriptions following.
[4] Potential for application can be high (+++), moderate (++), or slight (+).
[5] Herbs: chervil, chives, coriander, dill, sorrel and watercress.

Source: Saltveit, M.A. 2001

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