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POST-HARVEST REFRIGERATION IN KOSOVO

KOSOVO CLUSTER AND BUSINESS SUPPORT PROJECT



February 6, 2008

This publication was produced for review by the United States Agency for International Development. It was prepared by the KCBS project team of Chemonics International Inc. based on a Final Report prepared by Short Term Technical Advisor, Mr. Henry B. Bonar II.

POST-HARVEST REFRIGERATION IN KOSOVO

THIS REPORT PROVIDES EXPERT ADVICE ON EFFICIENCY IMPROVEMENTS TO FREEZING AND FROZEN STORAGE FACILITIES, PROCESSING FLOW, AND THE INSTALLATION OF STATIONARY FREEZING TUNNELS.

POST HARVEST REFRIGERATION OF CHILLING, FREEZING AND FROZEN STORAGE CAN BE AN EFFECTIVE WAY TO ENHANCE QUALITY AND SANITATION, SHELF LIFE, AND PROVIDE VALUE-ADDED BENEFITS TO PRODUCTS.

Kosovo Cluster and Business Support project – “Post-Harvest Refrigeration in Kosovo”

Contract No. AFP-I-00-03-00030-00, TO #800

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The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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PURPOSE OF ASSIGNMENT

The purpose of this assignment is to provide expert advice on efficiency improvements to freezing and frozen storage facilities, processing flow, and the installation of stationary freezing tunnels. The assignment is a continuation of assistance by KCBS to entrepreneurs in the fruit and vegetable industry in post-harvest handling and marketing.

The consultant will strive to enhance the efficiency of existing facilities, proposing new cost-efficient equipment only when necessary. The consultant will provide designs to improve product flow, reduce post-harvest bottlenecks, and provide multiple sourcing options, which will address installation, operating and maintenance costs. The consultant will visit organizations in need of re-engineering to recommend solutions to refrigeration problems and product flow processes.

The consultant will also conduct a one or two-day workshop for refrigeration engineers to address potential improvements to existing equipment and also the design, installation, use and maintenance of stationary freezing tunnels. The consultant may be “shadowed” by up to three local refrigeration engineers for whom KCBS, through this assignment, is providing training and exposure to refrigeration problems and opportunities.

BACKGROUND

Most of the freezing and frozen storage facilities used by Kosovo blueberry exporters are not new. In many cases the refrigeration technology is energy-inefficient and the physical handling or production flow process includes bottlenecks. Effective post-harvest refrigeration of chilling, freezing and frozen storage can be an effective way to enhance quality and sanitation, shelf life, and provide value-added benefits to products. In addition, preservation can provide market benefits in being able to sell products all months of the year in lieu of what the market provides at the time of harvest. This, of course, has the benefit of adding employment of more people for longer periods of time.

EXECUTIVE SUMMARY

The current primary market for most of the Kosovo products is export as opposed to domestic. Almost all products which lend themselves to freezing could enjoy better market prices if frozen and sold during “off-growing” season times of year.

To provide a finished product, several considerations in facility construction need to be considered - primarily such things as grading, washing, and sanitation standard of the areas in which the product will be marketed. Better packaging of a product could be an additional source of revenue, when frozen product can be packaged and moved to market continually.

As value-added services are provided, the facilities may need to consider many aspects of requirements for sanitation standard. In trading with the EU, meeting requirements may involve many aspects of the facility such as restrooms, showers, etc.

Freezing of perishable products, generally a seasonal occurrence, could be provided at all facilities. Although some would require significant changes or the construction of new facilities for both freezing and storage, it goes without saying that product quality and sanitation is jeopardized if fresh product, chilled or not chilled, is placed on refrigerated trucks and transported considerable distances for export.

FIELD ACTIVITIES TO ACHIEVE PURPOSES

Fieldwork consisted mainly in visiting fruit and vegetable processors to study their refrigeration practices. Visits were also made to two manufacturers of refrigeration equipment to evaluate their capability in constructing plants and providing refrigeration equipment and systems to suit upgrades at Kosovo processors. From one of the manufacturers, ELING in Gjilan, two engineers accompanied the consultant on his field visits to record his observations on improvements that need to be made to each plant. The objective of these joint visits was to embed some of the STTA's knowledge and experience in a Kosovo business and ensure this visit translates into sustainable improvements.

Inspections at facilities included obtaining development data pertinent to the facility's operation, including tonnage and power cost (when available), as well as studying methods of handling product. Dependent on the facility's location, design sketches and suggested methods for tunnel room freezing were provided.

Descriptions of each Field Visit are reported in Annex I.

In addition to the field visits, the consultant conducted a seminar on 25 January, attended by 15 participants from the processing and the manufacturing companies. The seminar addressed:

- Presentation of freezing methods used for multiple products in the US;
- Provision of information pertinent to the handling and freezing of mushrooms and fruits and vegetables;
- Recent methods and commodity information through the IARW/WFLO commodities manual;
- Description of how this association can be joined and used;
- A typical layout for a refrigerating facility and discussion of pertinent aspects for processing, storage and treatment of product.

TASK FINDINGS AND RECOMMENDATIONS

Findings and recommendations specific to each plant visited are recorded in the Field Visit reports. Observations in general are set out below.

Currently, the efforts of the entrepreneurs in the harvest of mushrooms, fruits and vegetables vary widely. The facilities being used to accomplish the process also vary significantly. The range of capacity varies in the following areas:

- 1) **Physical facilities:** These vary from very small receiving areas having no cold rooms or stores with no formal sanitation policies, to fairly well laid out rooms with process rooms, storage, and freezing tunnel rooms. All the facilities reviewed were placed on grade, (not dock height). Some of the facilities had provisions for amenities such as floor drains, lights, etc.
- 2) **Freezing capability:** Most facilities did not have freezing capability. Those that did had a room set up that would generally freeze over night or in 4 to 6 hours. Freezing was normally done in trays, stacked in front of, or below, air units. Frozen product would then be placed in plastic bags, or plastic lined boxes for shipping.
- 3) **Product grading ability:** Grading of mushrooms was common, where some sizes and species were selected for fresh, while others may be sliced, dried and/or frozen.

- 4) **Market opportunities:** It would appear that almost all products which lend themselves to freezing could enjoy better market prices if frozen and sold during “off growing” season times of year.
- 5) **Production capabilities:** While most of the natural products are season dependent, cultivated mushrooms can be grown year-round. This can provide year-round employment.
- 6) **Packaging capability:** To provide a finished product, several considerations in facility construction would need to be considered. Primarily such things as grading, washing, and sanitation standard of the areas in which the product will be marketed. The packaging of a product could be a continual source of revenue, where frozen product can be packaged and moved to market continually.
- 7) **Distribution capacity:** Some processors had refrigerated trucks. Depending on the market, the capacity to deliver may be a desirable value-added service.
- 8) **Facility sanitation:** As “collectors” of fresh product, this may not be a concern. However, as value-added services are provided, the facilities may need to consider many aspects of requirements for sanitation standard. In trading with the EU, meeting requirements may involve many aspects of the facility such as restrooms, showers, etc.
- 9) **Storage capacity:** Storage rooms would be needed to provide processing storage capacity so yearly production can be packaged throughout the year. Overall efficiency of processor can be enhanced by year round operations.
- 10) **Electric power viability:** While not directly part of this report, availability of electrical power will affect the efficiency of freezing operations. Generators can be used when power is not available, but this will increase operating cost.

While all producers buy from local “pickers” and harvest people, availability of labor fluctuates. Generally, harvest occurs when school students are available to assist. One company was producing mushrooms and will be able to employ local people year-round.

Freezing of perishable products, generally a seasonal occurrence, could be provided at all facilities. Although some would require significant changes or the construction of new facilities for both freezing and storage, it goes without saying that product quality and sanitation is jeopardized if fresh product, chilled or not chilled, is placed on refrigerated trucks and transported considerable distances for export.

The consultant gave advice to those producers who were looking at construction of new facilities, regarding wall construction technique, as well as general concepts, such as sanitation advantages of dock height.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTIVITY

The improvement of existing processing operations of mushrooms and fruits and vegetables is a multiple faceted effort at best. Installation of “tunnel” or Blast freezers (high velocity air) is part of the solution. To assume a freezing operation is installed is to assume a packaging operation would be installed concurrently. If value-added processes such as packaging are provided, then amenities such as grading, cleaning, etc. would need to be provided. If markets other than local were to be considered, then sanitary standards of export countries would also need to be considered.

These changes are all achievable for the processors. The basic design as described in the USAID seminar on 25 January, such as dock height facility, process flow pattern, freezing rooms and basic amenities would put the processors well on the way to providing efficient operations including freezing, handling and storage.

In several cases the entrepreneurs may need to understand why a different facility is better than what they currently have to satisfy market requirements.

To consider alternative recommendations, it may be appropriate to consider what cost of facility components may be. The following is based on US dollars for components. Although all facilities may not need all components, it will provide an indicator on the possible investment or equities needed.

Items	Estimated Cost
1) Tunnel freezer (Room freezer), Three ton per day	\$45,000
2) Freezer Storage room (9.0m X 7.2m)	\$52,000
3) Cooler Storage room (4.3m X4.3m)	\$28,000
4) Shipping (receiving) Dock (4m X 6m)	\$22,000
5) Processing (5.2m X 7.5m)	\$29,000

The above assumes to include all costs such as site work, electrical, etc.

ANNEXES

Annex 1: Field Visit Reports:

- Amkos
- APC
- AS Promet
- Besiana
- EuroFruit
- UVB Blagaja
- Fungo
- Hit Flores
- Katarina
- OSA Thermosistemi
- ValFrigo
- Eling

Annex II: Sketch Layout for Cold Storage Plant



OVERALL FLOOR PLAN
SCALE: 1/4" = 1'-0

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DRAWING	A-1
DATE	FEBRUARY 1, 2008
PROJECT NO.	0804

KOSOVO COLD STORAGE
MUSHROOM / BLUEBERRY
POST HARVEST PROCESSING
PRISTINA, KOSOVO



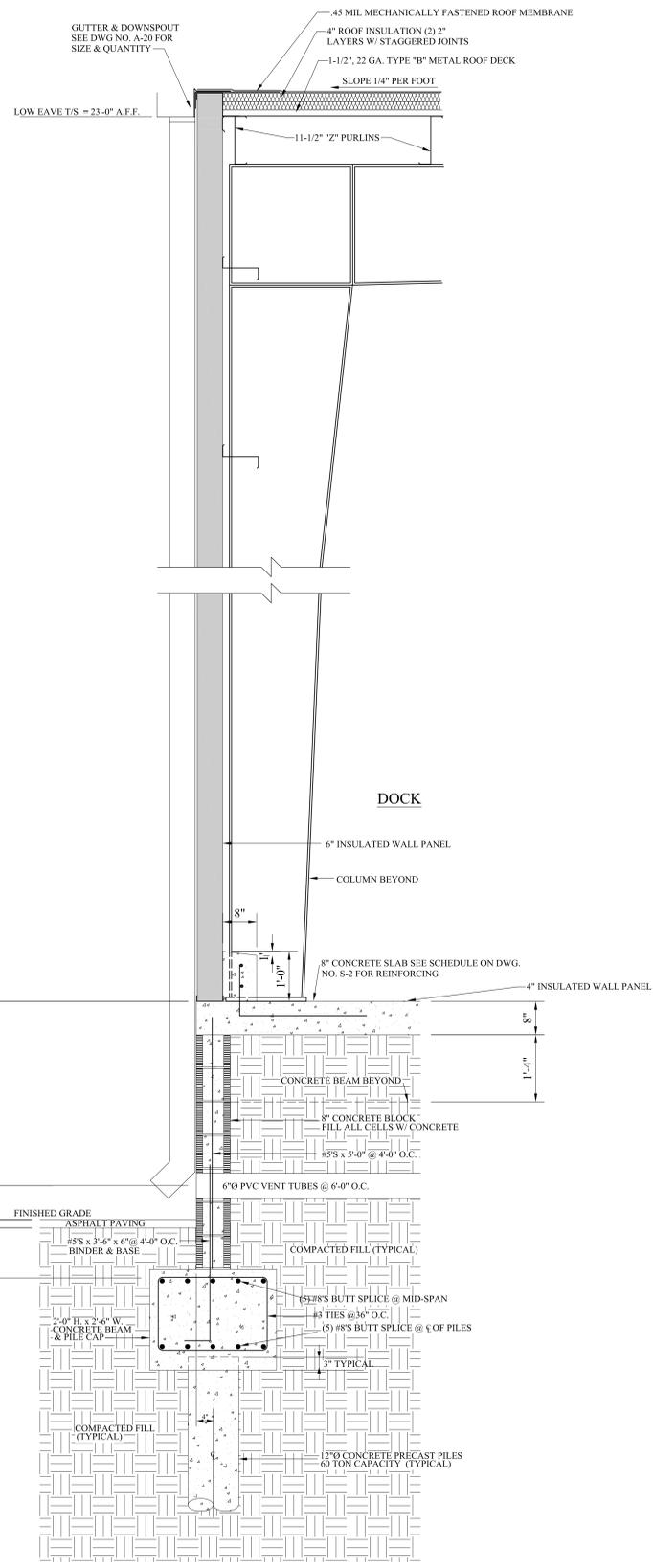
SCALE	AS NOTED	DESIGNED BY	H.B.B. II	DRAWN BY	G.J.L.	CHECKED BY	H.B.B. II
R E V I S I O N S							
NO.	DATE	DESCRIPTION	BY				

OVERALL FLOOR PLAN

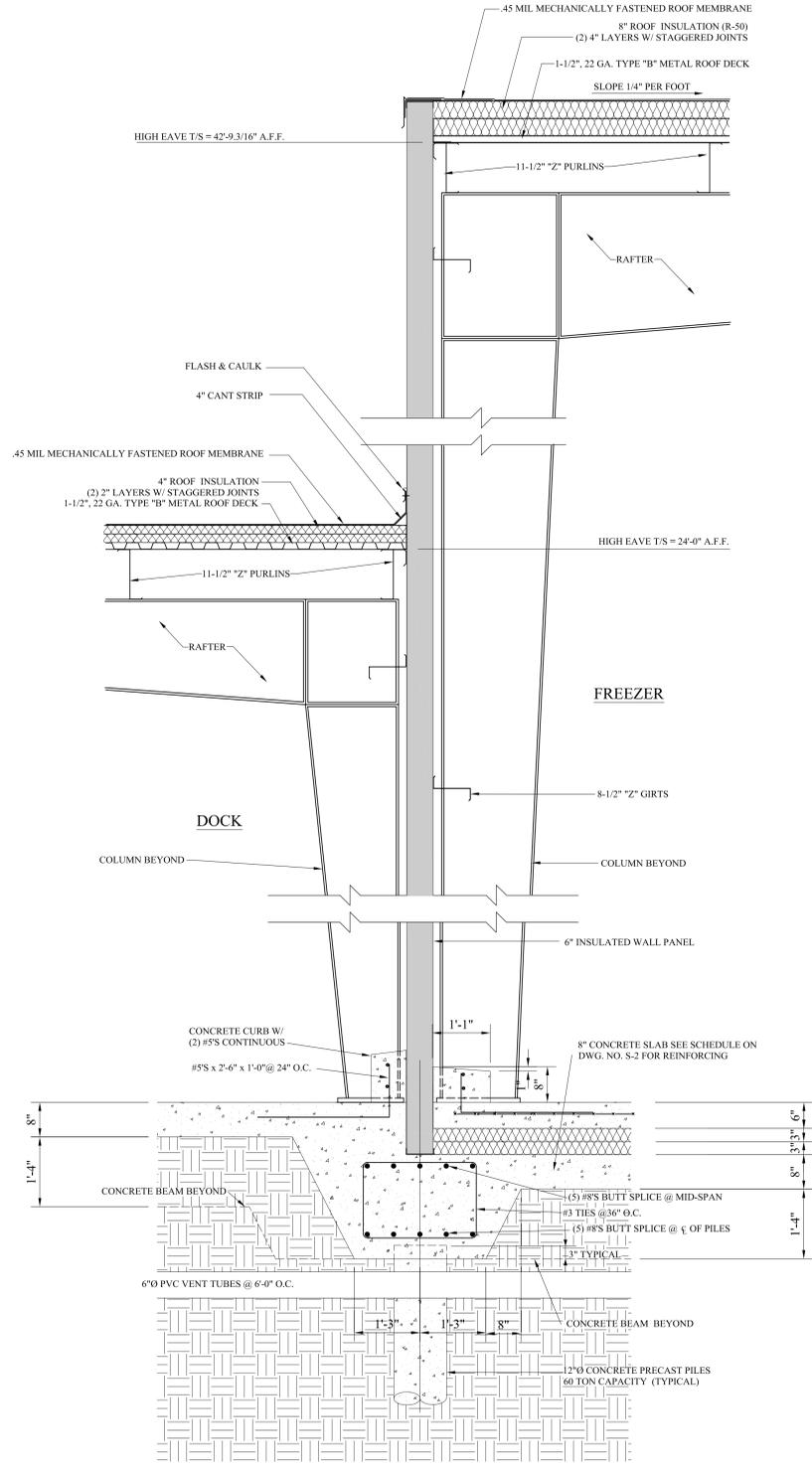
REGISTERED ENGINEER

DO NOT SCALE THIS DRAWING . DIMENSIONS AND NOTES TAKE PREFERENCE

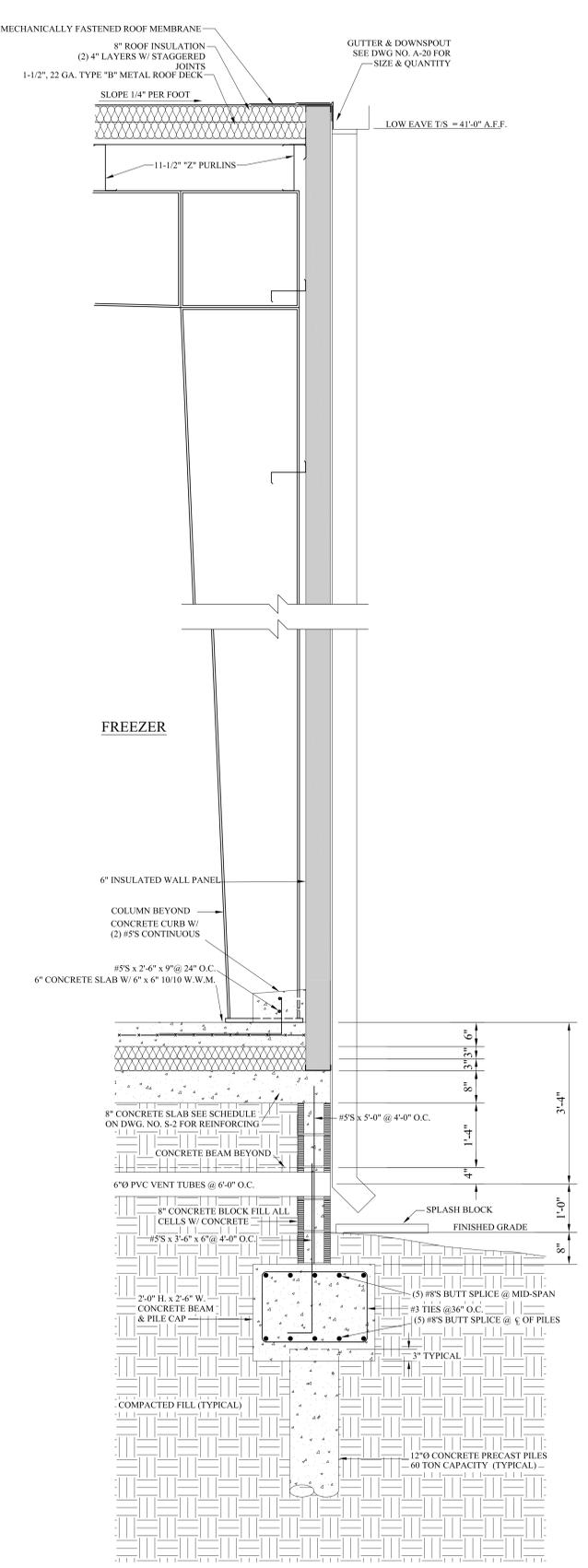
NOT FOR CONSTRUCTION



DETAIL 3
SCALE: 3/4"=1'-0"
A-11



DETAIL 2
SCALE: 3/4"=1'-0"
A-11



DETAIL 1
SCALE: 3/4"=1'-0"
A-11

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REGISTERED ENGINEER	
NO.	DESCRIPTION
DATE	BY
SCALE	AS NOTED
DESIGNED BY	H. B. B. II
DRAWN BY	S.T.
CHECKED BY	H. B. B. II
WALL SECTIONS	
KOSOVO COLD STORAGE MUSHROOM / BLUEBERRY POT HARVEST PROCESSING PRISTINA, KOSOVO	
 World Food Logistics Organization The Refrigeration Research & Education Foundation	
BONAR ENGINEERING & CONSTRUCTION ° REFRIGERATION	
DRAWING	A-1
DATE	FEBRUARY 1, 2008
PROJECT NO.	0804

INSPECTION DATA

Company Name: **APC Agroproduct Commerce**

Date of Inspection: January 21, 2008

Plant Address: Fshati Peran
11000 Podujeve, Kosove

Plant Telephone and Fax Number: t. +377 44 501 399 f. +381 38 571 614

Email: www.apc-kosova.com
Avnishabani65@hotmail.com
avni@apc-kosova.com

Name of Interviewee: Avni Shabani, Director

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Power/Energy Costs:

13-18 euro cents per kwh

\$700 – 1000 euro per month for energy

\$1,500 euro per month expected in future

Electricity is obtained thru direct link to distribution center. Using transformer, paying in advance. Has generator for emergency backup.



Products per year:

300 - 400 tons, 70% mushrooms and 30% blueberries
Future expectation is 50/50% mushroom and blueberries

Pounds Frozen per year:

35% freezing
35% fresh
20% drying then freezing
10% boiling then canning



Date facility was built:

2001, with no additions

Season/Processing period:

Mushrooms have 2 crops, end of May thru early July season collection and end of August thru mid October. Blueberries mid June thru August. Processing for 10 months, beginning in June. Rooms used the least December thru May.

Rooms/Space:

6 rooms total

1. 360 cm, 15x6x4
regime temperature convertible -20/+40
insulation 100 mm per panel
2. 120 cm, 8x5x3
regime temperature convertible -20/+40
insulation 200 mm per panel
3. 120 cm, 8x5x3
regime temperature convertible -20/+40
insulation 200 mm per panel



4. 210 cm, 14x5x3
regime temperature convertible -20/+40
insulation 200 mm per panel
5. 180 cm, 12x5x3
regime temperature convertible -20/+40
insulation 200 mm per panel
6. 60 cm, 5x5x3, freezing tunnel
regime temperature convertible -20/+40
insulation 200 mm per panel

Distribution:

Fresh mushrooms shipped via small aircraft, can hold approximately 1,000 kilos per trip and frozen mushrooms via trucks to Europe with capacity of 15 tons. Must pay for non-Kosovo trucks to cross borders into other European countries.

Pallet size: 120x80 cm

Questions from Interviewee:

1. He freezes mushrooms, packed in carton and plastic wrap, puts in cold storage and crystals/defrost form. This does not happen in large storage room, happens in smaller ones. Why?



H. Bonar Response: He is not sure what may be causing it. However, for moisture to leave the product would imply that the air around the product contains less moisture. Or, has less “vapor pressure” than the temperature and/or internal vapor pressure that the product was exhibiting, ie if the product had been warmed slightly during packaging and placed in a room colder than the product the moisture would tend to come out of the product. As an experiment, H.

Bonar suggested that a test bag with slightly “moisturized” product and/or small amount of moisture inside product’s container, and observed when placed side-by-side current product.

2. Which is better, ammonia vs. Freon compressors?

H Bonar Response: Ammonia could be considered if refrigeration requirements are greater than 300 kw. Over that, the following would apply. The primary differences are in three areas.

- 1) The central systems used in ammonia use



evaporative condensers (operate at wet bulb condition) while Freon package systems use air cool condensers. This requires compressors to operate at higher discharge pressures requiring 30 - 50% more energy.

- 2) The loss of refrigerant is typically 25% of the refrigerant charge per year with Freon versus 3 - 5% for central ammonia.
 - 3) The life of hermetic compressors and open Freon compressors are typically 3 – 5 years between major overhauls while industrial ammonia compressors can last 10 – 15 years and can last the life of the system, which can be 30 – 50 years.
3. Which is better freezing product by cold air or CO2?

H Bonar Response: While this can be debated for some products, generally freezing with cold air of mechanical refrigeration systems would be about 1/3 the cost of CO2 cryogenic freezing. In addition, the atmosphere with CO2 is very “dry,” no moisture, so any product that will give up moisture will do so. There are some products whose surface would congeal, such as hamburger patties, whose moisture would be “locked in” or released slowly once the surface was cold. It could be debated whether other advantages such as smaller ice crystals for a faster freeze could be justified from a quality perspective. A few high value products, such as shrimp, can justify CO2 freezing in some instances.

Remarks:

1. This operation and facility exhibited many characteristics of well-managed and sanitarly operated processing and freezing of vegetables and fruits. Given growth in markets and perhaps additional products to lengthen their processing season the operation could be significantly expanded.
2. Eventually the plant can grow where a dock height operation may improve efficiency and help maintain sanitary conditions.
3. With significant growth in the plant size, the freezing cells (tunnels) can be enhanced to handle the additional volume and maintain and/or improve the freezing times and product quality.



INSPECTION DATA

Company Name: **AMKOS**

Date of Inspection: January 21, 2008

Plant Address: Hasan Pristina
Podujeve, Kosove

Plant Telephone and Fax Number: t. +381 63 71 34 612 t. +377 44 170 077

Email: amkos_1980@hotmail.com

Name of Interviewee: Agim Hasani

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Facility Type:

Chilling facility only, no freezing currently

Date facility was built:

1983, 25 years ago

Facility additions:

Freezing facility forthcoming

Products:

Mushrooms mainly, and blueberries and rose hips. Only chilled, not able to freeze, boil and dry instead. Also jar in olive oil. Chill in wooden boxes. 100 tons mushrooms per year. 50 tons blueberries R12 Freon chilling

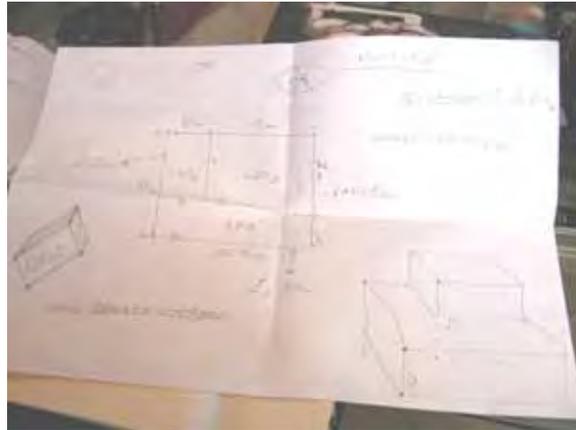
Rooms/Space:

1. Truck 7x2x2.20
2. Room 12x2x2.3



Remarks:

1. Amkos currently has preliminary plans for construction of a larger facility. This would include a process and storage area. They are well established in their market having served it for many years and growth appears inevitable. They currently use one refrigerated truck.



2. Currently, they seem to have a “niche” market in the drying of mushrooms and packaging of mushrooms. They mechanically have a tunnel which provides air for drying. They also have a mushroom slicer they designed and developed for this purpose.



INSPECTION DATA

Company Name: **AS Promet**
Date of Inspection: January 31, 2008
Plant Address: Leposalic
Plant Telephone and Fax Number: N/A
Email: N/A
Name of Interviewee: Ivaln Vukozić
Name of Interviewer: Henry Bonar, II

Room sizes

Overall 12.9m X 19.8m X 5.48m
High

Process area 5.2m X 7.5m X 3m

Cooler area 4.3m X 4.3m X 3m

Freezer area 9.0m X 7.2m X 3m

Tunnel Freezer 4.3m X 4.3m X
2.8m



Power/Energy Costs:

New Plant, has not started

Products per year:

Mushrooms 40 tons

Blueberries 20 to 40 tons

Rose Hips 10 tons

Juniper 30 to 40 tons

Pounds Frozen per year:

Last year none, Expect 3 to 5 ton/day

Storage capacity

The Freezer storage capacity is 4 ton.

Date facility was built:

Facility was built in 2008 at a cost of approximately 100,000 Euro.

Began business without facility, expects to increase production several fold.



Refrigerant used:

Freon R-22 and 404A

Season/Processing period:

Plant is constructed adjacent to plume orchard.

Remarks:

- 1) Ivaln has been in business and is in a good position to expand.
- 2) I would expect in 10 years Ivaln will have significant “growing pains” and need to expand.

INSPECTION DATA

Company Name: **Besiana**

Date of Inspection: January 24, 2008

Plant Address: Ferizaj, Kosove

Plant Telephone and Fax Number: t. +0290 322 143 m. +044 121 936

Email: besiana1@hotmail.com

Name of Interviewee: Gani, Alia and Feride Aliu

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Power/Energy Costs:

80 – 90 Euro per month when not using cold rooms
600 – 700 Euro per month
KWH unknown

Products per year:

Mushrooms 70 tons
Blueberries 80 - 120 tons (says largest blueberry collector in Kosove)
Rose Hips 70 tons



Pounds Frozen per year:

20% frozen
60% fresh
10% drying (sliced)
10% boiling

Freeze mechanism for mushrooms, divides better from worse and freeze both separately

Initially freezes in wooden crates/baskets, approx 3 days, which helps because he has small space. After frozen, he puts in bags and sends them to buyer. He has a special relationship with a buyer to take them as ready.

Blueberries/rose hips distributed via truck in 8 – 10 kilo plastic bags during season. If market price too low, product frozen in bags.

Refrigerant used:

Freon R-502

Season/Processing period:

Mushrooms season May through June, blueberries June through August, mushrooms again September through December.

During busy season will keep 10 tons in storage area.

Rooms/Space:

2 rooms total, both freezers, alternate usages

2 refrigerated trucks

1. 7.6x4.5x2.5 meters temperature -25C
insulation 15 cm, styrofoam
2. 6x3.8x3 meters
temperature -25C
insulation 15cm, styrofoam

Distribution:

Via truck, mushrooms 5 tons per day, blueberries up to 17 tons per day

No pallets used, mushrooms in cardboard boxes, blueberries plastic boxes

When frozen, bags in boxes.

Compressor:

Copelamatic, German

Remarks:

1. Gani and his family are well established, although their operation being located in the confines of a city environment will make growth difficult.
2. Eventually, the plant can grow where a dock height operation may improve efficiency and help maintain sanitary conditions.

INSPECTION DATA

Company Name: **Eling**

Date of Inspection: January 28, 2008

Plant Address: Dardania 1 Rr 111 Nr11
Gilan-Kosovo

Plant Telephone and Fax Number: t. +381 280 329861 m. +381 0 44 144 418

Email: eling@hotmail.com

Name of Interviewee: Zijadin alili

Name of Interviewer: Henry Bonar, II

Sales:

In 2007, they had sales of 350 to 400,000 Euros.

Staff:

They employ around 7 + 6 seasonal people. They also have other businesses than refrigeration, such as kitchen counters and cooking equipment which helps keep the employees busy year round.



Equipment:

They have a machine shop and sheet metal fabrication equipment.

Refrigeration Systems:

Compressors: This varies on size of application although Bilzer (Germany) is favorite. 25 to 30 per year.

Evaporators: Generally are ECO and OSA, and in copper alum fin.



Condensers: Are usually Fretherm Italy

Refrigerant: The primary refrigerant used 22, 404A, and 134A. The costs vary 404 87 Euro, for (13.2Liter), 60E R22.

Refrigerant Oil: Oil is normally one of two types SAE90 R-22 used for 404, and Suniso 3GS.

Controls: They usually use Dorin, Bitzer, Copeland, or Refcompo

Remarks:

- 1) They have a 2,000m³ project.
- 2) Their complementary business in sheet metal will be a plus in the refrigeration installations.
- 3) In addition, they have an engineering staff for design and installation of refrigeration and insulation systems.

INSPECTION DATA

Company Name: **Eurofruti**

Date of Inspection: January 24, 2008

Plant Address: Mramoh
Ajvali, Kosove

Plant Telephone and Fax Number: t. +377 44 173 331

Email: eurofruti@hotmail.com

Name of Interviewee: Betush Gashi

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Products per year:

Blueberries 100 tons per yr
Mushrooms 120 tons per yr
Rosehips 200 tons per yr
Red peppers 200 tons per yr (just added last year)

Pounds Frozen per year:

All of the above frozen.

Date facility was built:

1980's
Addition expected 2009



Refrigerant used:

Freon R-12 and R-22

Season/Processing period:

Mushrooms
30 – 40% dried; sliced, 1,500 kg for
24 hours
50% fresh

20% freezing and boiling (150 kilos boiled in barrels sold to Italy)
All mushrooms in Kosovo exported

Rooms/Space:

3 Rooms

1. freezer, 6x9x2.5, Freon R-12, 20 kw
2. freezer, 4x5x2.5, Freon R-22, 8 kw
3. chiller/cooler, 3.5x6x2 meters (at his home)



Building additional site for process plant to include steel frame, 20x35x4 meters, insulation panels (manufacturer Ital Panelli) 5 cm inside 15 cm total 20 cm

Land cost approx \$105,000 Euro (3,000 Euro for 1 R or 100 meters, 100 m)

H. Bonar draws an extensive design for new facility. He explains how he would build the new site versus how the current plans are to be built out of concrete. The non concrete approach will allow for better vapor barrier, efficiency and cost savings. Also, installation for freezers typically use 5 – 6” made from polyurethane, which is better than styrofoam.

Most food warehouses are built dock height for several reasons: 1) When using large tractor/trailer, it can back up into the warehouse 2) Sanitary reasons to keep out the rodents, etc. 3) Allows heating system to come directly out of the wall 4) The additional property is flat and will need to have loading area higher if constructed on grade.



Distribution:

Fresh mushrooms transported to Europe in cooling truck.

Frozen in 10 kilo bags into box covered in plastic same way.

Currently mushrooms exported to producer in Europe and labeled with another company's label. In future, after addition completed, will process and label with own Eurofruti label so obtain additional

profits. From this endeavor can employ 30 employees year round and 150 additional employees during season.

Last year he negotiated with German company he met at trade show to export red peppers and mushrooms.

He expects to negotiate and sell red peppers for .30 Euro per kg (price 2007). However, 2006 pepper went for .10 Euro. 2008 willing to pay .30 Euro again, will freeze and box them and send to Europe. 2007 200 tons fresh peppers shipped to two buyers. Point is price fluctuates greatly, depending on size of crops, market, etc.



Remarks:

1. Betush is making plans to construct a facility on land not far from his home. He is looking for advice to construct it properly.
2. He should consider building the new facility to include dock height amenities. For both sanitary and handling efficiency reasons, a dock height facility would be advantageous.



INSPECTION DATA

Company Name: **Fungo FF**

Date of Inspection: January 26, 2008

Plant Address: Fatmir Krasniqi

Plant Telephone and Fax Number: t. +381 0 280 371 032 m. +377 0 44 167 748

Email: fungo_ff@hotmail.com
www.fungo-ff.org

Name of Interviewee: Fatmir Krasniqi

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Power/Energy Costs:

300 – 600 per month (35 Euro per kw per hour)

Products per year:

Mushrooms 100 tons
Blueberries 40 tons
Cultivated champignons
mushrooms 30 tons

Pounds Frozen per year:

Last year due to electrical problems could not freeze any mushrooms.

He has freezing tunnel.

Freezes mushrooms at -35 - -40C, 3-4 hours; 3 tons per 24 hours, freeze in plastic box, 700 kg per box, 6 hours on pallets.

Date facility was built:

1990

Began business out of his basement. A lot of mushrooms in his area. First business was a matter of survival then fell in love with mushrooms. By profession he is a



lawyer. He likes mushrooms better than judges. Started company in 1990's when Albanians not allowed law professions.

Refrigerant used:

Freon R-22

Season/Processing period:

Started with wild mushrooms as main business. Secondary business cultivating/growing champignons mushrooms. Purpose of cultivating is to have process/work/income year round.

Wild mushrooms:

- 1) Receives mushrooms from field, if 5 – 10 cm high, he sells them fresh. Chilling them, putting into wooden boxes with no cover and transports them.
- 2) Less than 5 cm high, slicing, drying or freezing. If freeze, freeze in plastic bags, put into carton, then transports.
- 3) Percentage breakdown: Fresh more than 50%, 20% frozen, 20% dried, 10% boiled.

Blueberries:

Blueberries are more problematic for freezing. Blueberries need larger area and air flow is more difficult. In 2007, 90% transported fresh in open plastic containers/trays. 2 tray sizes; 7 – 8 kilos and 10 – 12 kilos.

Champignons mushrooms cultivation is 80 days total. 40 days in incubation then harvest begins for another 40 days. Less than three months for whole process. Compost imported, cannot reuse compost. If he had worms from CA to eat/clean soil he could reuse soil.

Rooms/Space:

3 rooms total

1. Freezer, 5x5x5 meters, -18C
2. Cooler, 5x5x3 meters, +3C
3. Tunnel, 4x2x3 meters, -40C



Transportation:

3 refrigerated trucks

80% of equipment made in Italy, including the 3 trucks are Italian.

Distribution:

Except for champignons mushrooms, all products exported through Italian Company to all of Europe; Italy, France, Turkey, also Serbia indirectly.

With wild products (mushrooms, blueberries) cannot control capacity. If had capacity could hold back supply, when price is down.



Remarks:

- 1) Fatmir has embarked on a full-blown mushroom business. With his cultivating of champignons mushrooms he has expanded his business many fold in making it year round. His in-depth knowledge of the mushrooms and their cultivation are going to be significant in his market.
- 2) I would expect in 10 years will be significantly more advanced than most of the other growers.
- 3) He is steadily expanding his growing “houses” and will no doubt continue to expand production.

INSPECTION DATA

Company Name: **Hit Flores**

Date of Inspection: January 28, 2008

Plant Address: Dragash
Kosove

Plant Telephone and Fax Number: m. +044 148 155 +044 203 679

Email: hit_flores@hotmail.com

Name of Interviewee: Arafat Bajrami

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Power/Energy Costs:

Using 3,690 watts per hour for electricity, compressor, etc.

Products per year:

Blueberries 100 tons (2007 not a good year 70 – 80 tons)

Rosehips 120 tons

Juniper berries 350 tons (2007 not a good year 200 tons)

Mushrooms 10 tons for drying

Tea, producing and packaging tea bags from various wild herbs, including chamomile, rosehips, hibiscus, mint

Pounds Frozen per year:

None currently

Date facility was built:

2007

Refrigerant used:

Freon R-22



Season/Processing period:

Mushrooms May through June, blueberries June through August, end of August juniper berries. Juniper berries grow best in a higher altitude, 8,000 – 15,000 meters.

Juniper berries dried so that moisture level is 14 – 18%, moisture level at time of picking when come from mountains is 22 – 36%. Producers then extract oil; 100 kg equal approximately 1 liter oil.

On average a collector/picker picks approximately 40 kg juniper berries.

On average a collector picks approximately 15 – 20 kg blueberries per day. With blueberries, collector receives 1.20 Euro per kg and he sells for 2.1 – 2.2 Euro. He is collecting 3 – 5 tons blueberries per day during season. Blueberries are graded when come in from collector, take out stems, etc. Stems used for tea. Collectors bring blueberries in small bends, approximately 7 kilo per bend, then transferred to plastic boxes for grading/sorting. Plastic boxes cleaned with new cleaning machine he recently purchased.

Rooms/Space:

1 Room, cooler

5x4x2.5 meters

0 - +5C convertible

Cooler to store blueberries and rosehips.

Recently installed a drying box just for Juniper berries.



Distribution:

Blueberries and rosehips transported in plastic trays.

Juniper berries are all exported for medicinal purposes in 30 kilo bags.

Expanding tea packaging to export and develop other tea packaging products. Wants to create link with U.S. where he has friends with businesses in Chicago and Boston.

Remarks:

1. Facility has no freezer for blueberries. Need to have ability to freeze to export year round into other parts of Europe.
2. A belt tunnel would also be helpful. A belt tunnel freezes in 8 minutes; all products in a line in finished form then transferred to freezer. Fast freeze IGF gives a better quality, smaller crystal formation.
3. Blueberries bruise quickly and easily during collection, transport and cleaning processes need to move quickly, get them frozen.
4. Obtain stationary tunnel freezer and expand freezing business.

INSPECTION DATA

Company Name: **Katarina**

Date of Inspection: January 22, 2008

Plant Address: Zvecan
Zitkovac

Plant Telephone and Fax Number: +063 224 700 +028 662 632

Email:

Name of Interviewee: Eduard (Edi) Ristovic Director

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Power/Energy Costs:

Estimated 13-18 euro cents per kwh

Unavailable

Products per year:

54 tons ice cream, 1,000 tons
meat, 40-50 tons vegetables/
year

Date facility was built:

1930

Refrigerant used:

Freon

Season/Processing period:

Mushrooms have 2 crops, end of May thru early July season collection and end of August thru mid October. Blueberries mid June thru August. Processing for 10 months, beginning in June. Food distribution of frozen products is year round business. Note other products such as water and beverages are distributed.



Rooms/Space:

2 rooms total

1. 120 m³, 12X4X2.4; -27C
insulation 100 mm per
panel
2. 5cm, 5X5X2.4; -27C
insulation 200 mm per
panel



Distribution:

Institutional places

Materials handling

One fork truck; two trucks

Remarks:

1. Needs sorting equipment for vegetables; green beans, sweet corn, broccoli and cauliflower.
2. The facility was a converted brick manufacturing plant and is currently being rented by Katarina. The plan is to purchase through privatization. The facility has many areas where a small storage room can be constructed.
3. The active nature of the owner would give rise to consideration of a dock height (truck receiving and shipping) facility capable of storage and wholesale/institutional (restaurants, schools, hospitals, etc) distribution to the market he is currently serving. Some of the current facility can very well be used for this purpose.

INSPECTION DATA

Company Name: **OSA TERMOSISTEM**

Date of Inspection: January 23, 2008

Plant Address: Bernjak
Rahovec - Kosove

Plant Telephone and Fax Number: t. +381 0 29 77 600 f. +381 0 29 77 880
m. +377 0 44 200 860

Email: arianosa@hotmail.com

Name of Interviewee: Arian Osa

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Date facility was built:

1987

Product:

Initially manufactured three types of condensers and products to clean air. Now also assembling refrigeration/heating display cases for use in markets, bakeries and large restaurant kitchens.



Background:

2003 privatized, now family sole owners. 42 employees including 5 mechanical engineers, 1 electrical engineer and 2 economists.

Refrigerant Used:

Moving from Freon air 12 to Freon 134A, 404A and 22. Still have products designed for 12. Freon 12 10% cheaper relative to 134A. The difficulty of obtaining Freon depends on the season; it is more difficult to get refrigerants during summer months.

Pipes:

Most pipes are made of copper aluminum and fins. Tube sizes are 10 and 12 mm.

Evaporators:

Typical space between fins is 2.8 - 6 mm also up to 12 mm but then pipe is visible. Defrost depends on project; both electric and hot gas systems available

H Bonar said CO2 for refrigerated warehouses is becoming more popular.

Expansion valve manufacturers are Danfoss and Spular (Italian).



Compressors:

Compressor manufacturers are Dorin (Italy) for large systems, Piston, Danfoss for small systems.

They have not used rack systems, but have heard of them. H Bonar said they are popular because they share common suction header and oil gets back evenly to each compressor.

Efficiencies:

There are US restrictions on efficiency. Currently no restrictions here but likely will be soon. The EU will make the regulations/requirements. There is no restriction on freezer capacity/dimensions they can assemble/manufacture.



Association:

There is not a formal Kosovo association for manufacturers or others in cold storage business. They agreed one should be created. They do participate in annual meetings/programs in Yugoslavia through an organization called KGH, but only a few participants from Kosovo. They discuss and learn about various topics such as climatization, ventilation, heating/cooling, etc.

Remarks:

1. OSA is in a good position to provide refrigeration equipment to the developing mushroom, fruits and vegetables market. They are very capable of providing custom evaporator air units for the refrigeration systems that would be required. In addition, they can manufacture condensers as well as compressor packages.

INSPECTION DATA

Company Name: **UVB Blagaja**

Date of Inspection: January 30, 2008

Plant Address: Blakaja
Peje, Kosovo

Plant Telephone and Fax Number: t. +377 044 431 215

Email: husnijabese@hotmail.com

Name of Interviewee: Husniga Beskovic

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Organizational Structure:

UVB is an association of 13 farmers growing “ajdared” (idared) apples. They participated in the first cold stage conversion project with USAID in Kosovo. Other producers are trying to replicate. (Muhamed said there were two others.)



Power/Energy Costs:

7 cents Euro per kwh

Products per year:



3-400 tons/year of ajdared apples are grown on the average. The apples are grown on 10,000 trees on 15 hectors. Total apple supply for Kosovo is 3,000 – 4,000 tons on 100-150 hectors. 10% of the national consumption.

Adjared apples are local, semi sweet and juicy, popular in the 1990’s, not as popular now.

Price: 30 (low) – 65 Euro per kg

Date Facility was built:

1950-60s

UVB recently converted 4 storages into a two room cold room facility. The growers paid for 40% of the conversion and obtained a grant from USAID for the remaining 60%.

Conversion began end of June 2007 ended September 2007.

UVB is experimenting with a plot of 500 trees and 10 new varieties of apples. Also involved with the experiment is decreasing the distance between trees from 5x4 meters to 1.75x3.8. Advantage of this is 1,300 trees can grow on one hecter versus 500. H Bonar mentioned different types of apples are stored at different temperatures.



Refrigerant used:

Freon R-22

Season/Processing period:

Mid September to June is the main harvesting time. Adjared apples are only popular locally, the rest of Europe does not care as much them.

Stored in wooden crates

Rooms/Space:

There are two rooms total in the converted facility.

Both rooms are 7x11x2.3; 403 m³ total.

Room temperature + 1.5 to -3.5 C convertible.

Insulated wall panels are 80 mm and ceiling 60mm.

Humidity is helped by putting water on floor.

There is storage capacity for 400 tons of apples.



Pallet size:

124x124 cm

Distribution/Transportation:

Transported locally in unrefrigerated trucks in wood crates. Also many buyers come to the farm.

Remarks:

- 1) With only 10% of the current apple consumption in Kosovo being grown domestically there is a great deal of opportunity for UVB to increase their business.

INSPECTION DATA

Company Name: **Val Frigo**

Date of Inspection: January 29, 2008

Plant Address: Nena Tereze nr.33
Peje-Kosovo

Plant Telephone and Fax Number: t. +381 0 39 434788 m. +377 0 44 509 989

Email: valdet@valfrigo.com
www.valfrigo.com

Name of Interviewee: Valdet Tatari

Name of Interviewer: Henry Bonar, II and Muhamed Disha

Sales:

In 2007, they had sales of 400,000 Euros, One project was 200,000 Euros

Staff:

They employ around 17 people. They also have other businesses than refrigeration which helps keep the employees busy year round.

Equipment:

They use three service trucks and two pickup trucks for construction.



Refrigeration Systems:

Compressors: This varies on size of application although Copeland scroll as well as a variety of piston compressors are used. Under 50HP usually 220 volt; over 50HP 380-400v 3Phase

Evaporators: Generally are Italian EKO. In copper alum fin.

Condensers are usually No name Greece, copper designed with extra capacity.



Refrigerant: The primary refrigerant used to be 12, 22, and 502; Now they use 134A, 407C from India, 410, 404, and 507. The cost vary 404 180Euro, 407 160Euro, for 25lb (11.7Liter). They refer R22 for 0-5C and R404 for -40C.

Refrigerant Oil: Oil is normally one of two types Suniso 4GS used for 404, and Suniso 3GS used on R-22, 12, and 502. Note the oil for 507 can cause blood poisoning,

arm to swell etc. They also use a mobile mineral oil. 3Liter from Greece 70Euro plus 26.5 for transportation.

Controls: They usually use a display Thermostat and set defrost for 15C with hold back of fan until -10C.

Power: Most of the local power is from a local hydroelectric plant, 8MW. If power bill was read correctly, it would appear that a total of 7,460 KWH was purchased for 389.35Euro or .052E/KWH or 8.5cents/KWH US.

Remarks:

1) Valdet is an accomplished refrigeration contractor. With his very good understanding of electrical power he is in a position to provide complete systems with good control systems.

2) Their complementary business in electrical inverters will be a plus in the refrigeration installations.

3) In addition, they have a transformer servicing business which can filter and “degas” transformer oil while it is operating.

