

**AN EVALUATION**

**OF**

**THE EFFECTS OF**

**Permafrost**

**ON A**

**REFRIGERATION SYSTEM**

**FOR A COOL ROOM**

**AT**

**GALIPO FOODS**

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**AUSTRALIA**

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## INTRODUCTION

The aim of this report is to examine the effects of a product known as PermaFrost upon the refrigeration system of the cool room at Galipo Foods. The refrigeration system utilized a Bitzer reciprocating air-cooled condensing unit, 4FC-52Y running on R-404A refrigerant.

PermaFrost has previously been claimed to enhance the performance of refrigeration and air conditioning systems elsewhere. Literature from the Polar Oil Company (which markets the product) states that PermaFrost – a molecular technology that relies on highly activated thermal conductive compounds - will improve heat transfer on metal surfaces and increase lubricity of the refrigerant oil.

It further states: “When PermaFrost’s *Thermo-Conductive* compound is added to the compressor, it blends with the oil and moves through the system. As each molecule attaches itself to metal surfaces within the system, it displaces dirt, carbon deposits, and stagnant oils, eventually forming a thin layer. As a result, the system can move more heat for the same amount of compressor action. Energy demand and consumption can be reduced.”

## **METHODOLOGY**

The testing procedure included an analysis of the refrigeration system on two occasions:

- 1) Before the addition of PermaFrost, and
- 2) After addition of the product.

To measure the performance of the refrigeration system, an “ETM” refrigeration system analyser was used to data log the operating conditions of the systems during testing. For each test, the analyser collected the data on the following operating conditions over a 1 to 2 hour period at one minute interval:

- Power input
- Cooling capacity
- Coefficient of performance (COP)
- Suction superheat
- Liquid subcooling
- Compressor discharge temperature
- Evaporating temperature & pressure
- Condensing temperature & pressure

## **TESTING**

The refrigeration system was first tested on October 18, 2004 before the product, PermaFrost was introduced into the system and then on November 1, 2004 after the treatment.

## **RESULTS OF TESTING**

Detailed results of the operating conditions are provided in the following charts, all found in Appendix A:

1. Pre-treatment Test (October 18, 2004)

Chart 1A: Cooling Capacity, Power Input & Coefficient of Performance

Chart 2A: Evaporating Temperature, Superheat, & Subcooling

Chart 3A: Condensing and Discharge Temperatures.

Chart 4A: Evaporator & Condenser Pressures

2. Post-treatment Test (November 1, 2004)

Chart 1B: Cooling Capacity, Power Input & Coefficient of Performance

Chart 2B: Evaporating Temperature, Superheat, & Subcooling

Chart 3B: Condensing and Discharge Temperatures.

Chart 4B: Evaporator & Condenser Pressures

## Observations

A comparison of the mean operating conditions for each of the tests are summarized in table below:

### Test Results : Operating Mean Values

	Pre-treatment	Post-treatment	% change
Cooling Capacity (kW)	10.57	11.84	12.02
Power Input (kW)	4.06	4.07	0.25
Coefficient of Performance, COP	2.60	2.91	11.92
Discharge Temperature (°C)	67.80	65.74	-3.04
Evaporating Temperature (°C)	-10.63	-10.56	-0.66
Condensing Temperature (°C)	34.89	34.01	-2.52
Superheat (K)	15.11	14.77	-2.25
Subcooling (K)	1.92	2.68	39.58
Condensing Pressure (bar)	15.07	14.74	-2.19
Evaporating Pressure (bar)	3.26	3.27	0.31

From this table, a number of observations can be made about the effects of PermaFrost on the refrigeration system of the cool room:

- Cooling capacity increased significantly by 12%. *This indicates a significant improvement in heat transfer in the evaporator.*
- The COP (a ratio of the cooling capacity and power input) increased significantly by a corresponding 12%. *This indicates a significant improvement in system performance.*
- Liquid subcooling also increased significantly by 39%. *This indicates significant improvement in heat transfer in the condenser.*
- The compressor discharge temperature was reduced by 3%. *This may indicate an improvement in the lubricity of the refrigerant oil in the compressor.*
- Insignificant changes in suction superheat, evaporating and condensing temperatures and pressures were noted.

## CONCLUSION

The tests carried out on the refrigeration system of the cool room indicated an improvement in the cooling capacity of 12 % and an increase in system performance of a similar 12 % after treatment with PermaFrost. **The increase in cooling capacity and system performance will result in the compressor using less energy to achieve the same cooling effect in the cool room.** The decrease in energy usage by the compressor will correspond approximately to the increase in the system performance. This is achieved by a reduction of the compressor run time to produce the same cooling effect in the cool room.

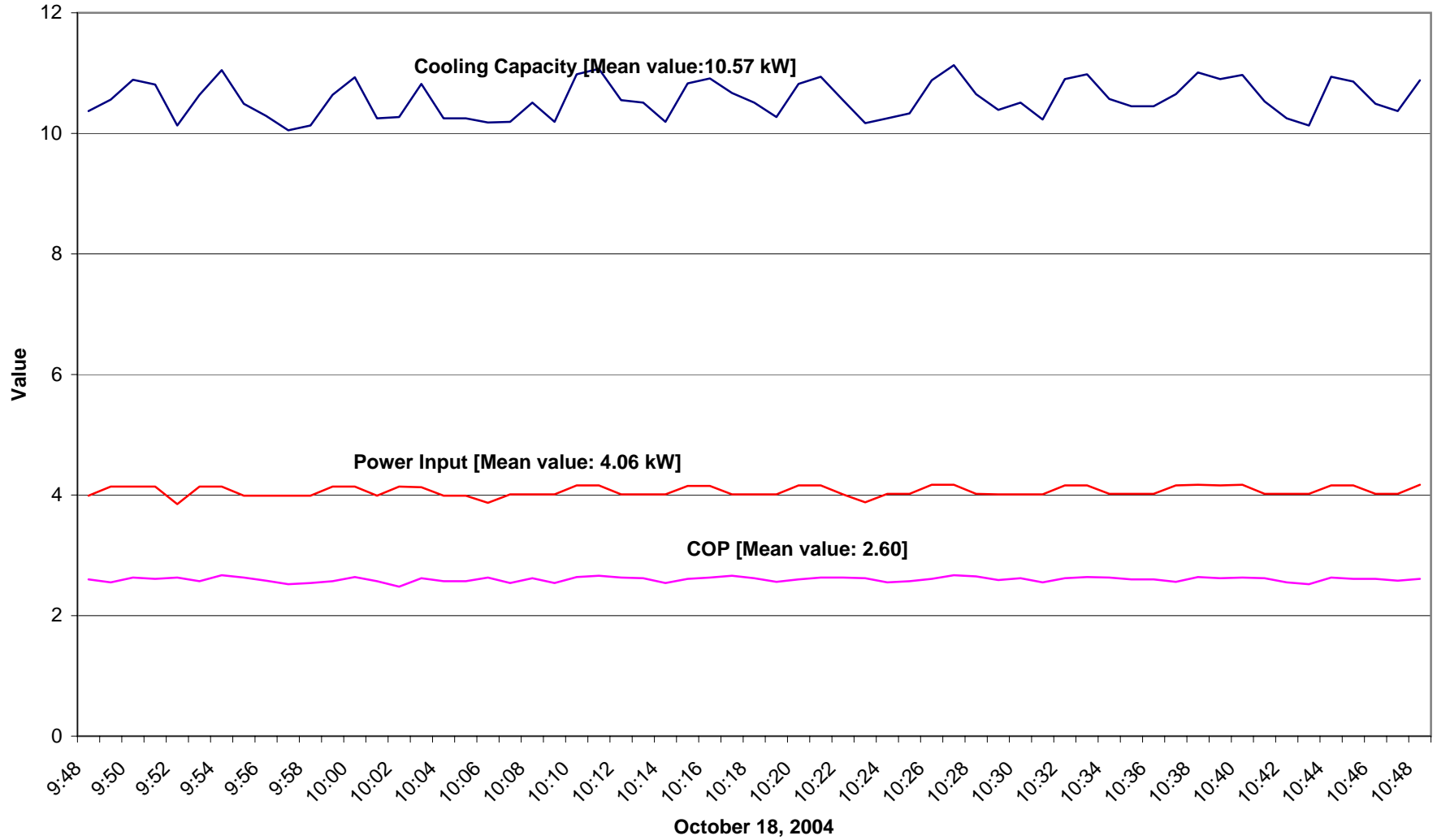
The salient results are summarized in the bar graphs in Appendix B.

# Pre Treatment Test

October 18, 2004

Appendix A

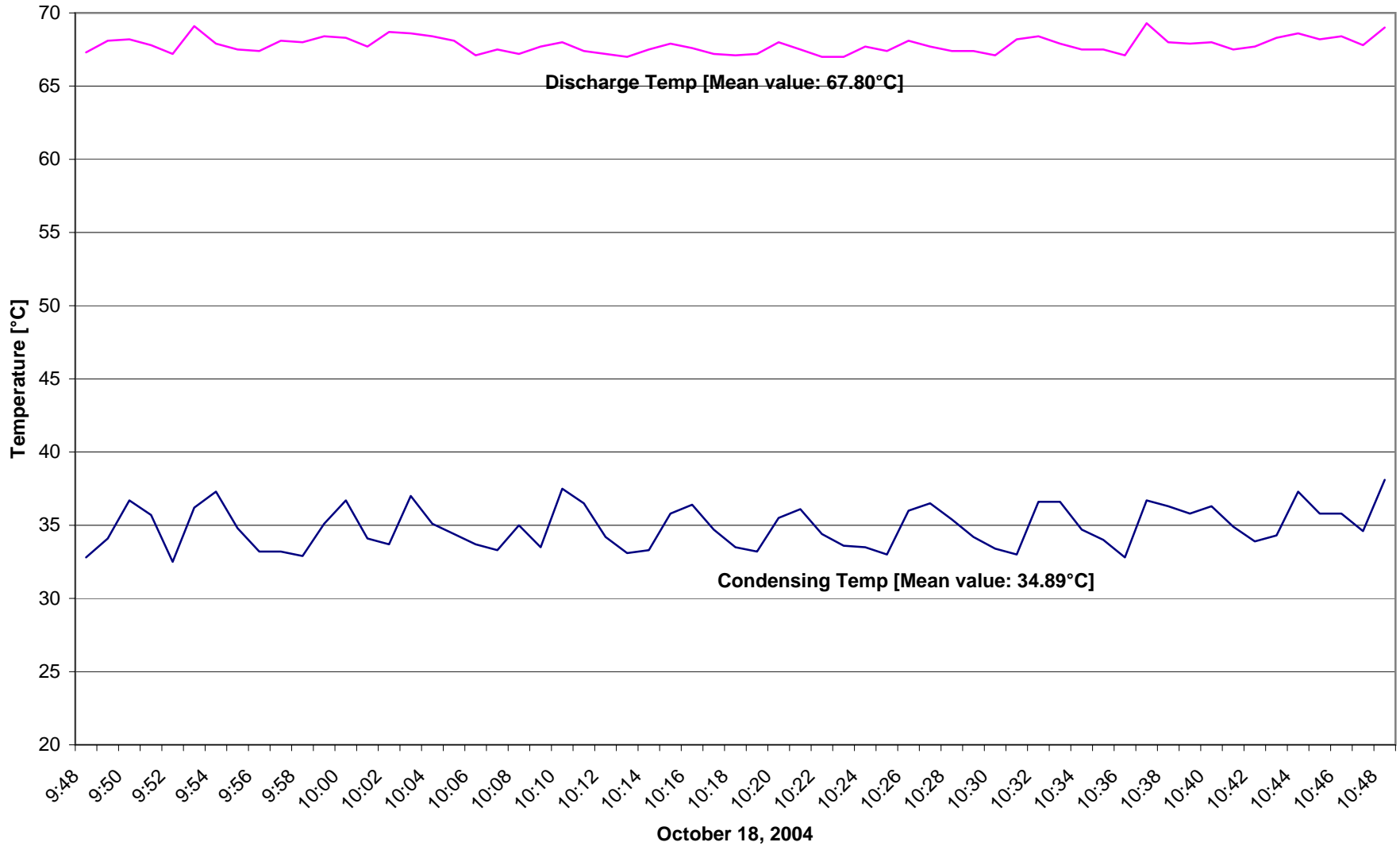
**Chart 1A - Galipo Foods Cool Room: Cooling Capacity, Power Input & COP  
[Pre-treatment]**



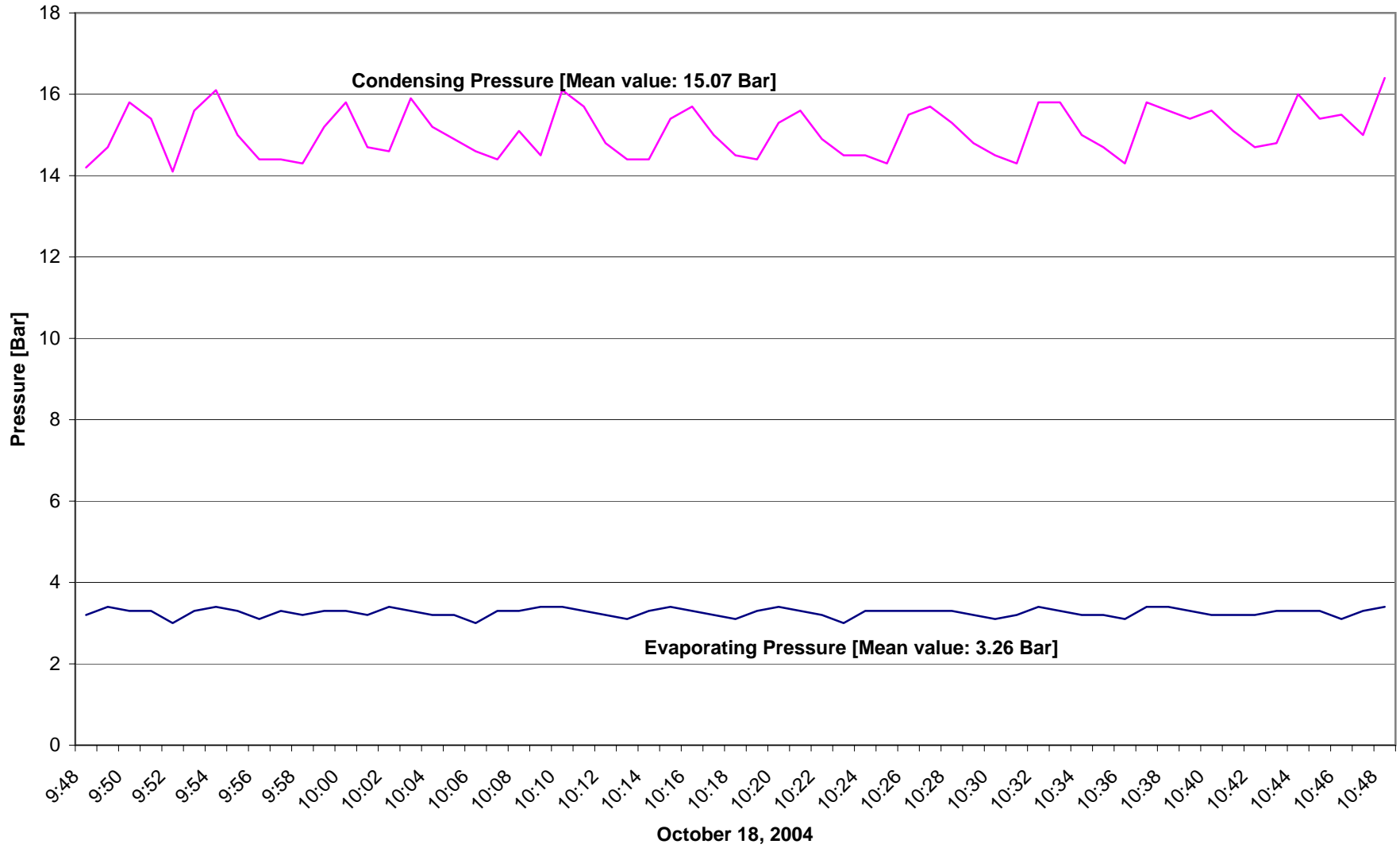
**Chart 2A - Galipo Foods Cool Room: Operating Temperatures (Pre-treatment)**



**Chart 3A - Galipo Foods Cool Room: Operating Temperatures (Pre-treatment)**



**Chart 4A - Galipo Foods Cool Room: Operating Pressures (Post-treatment)**

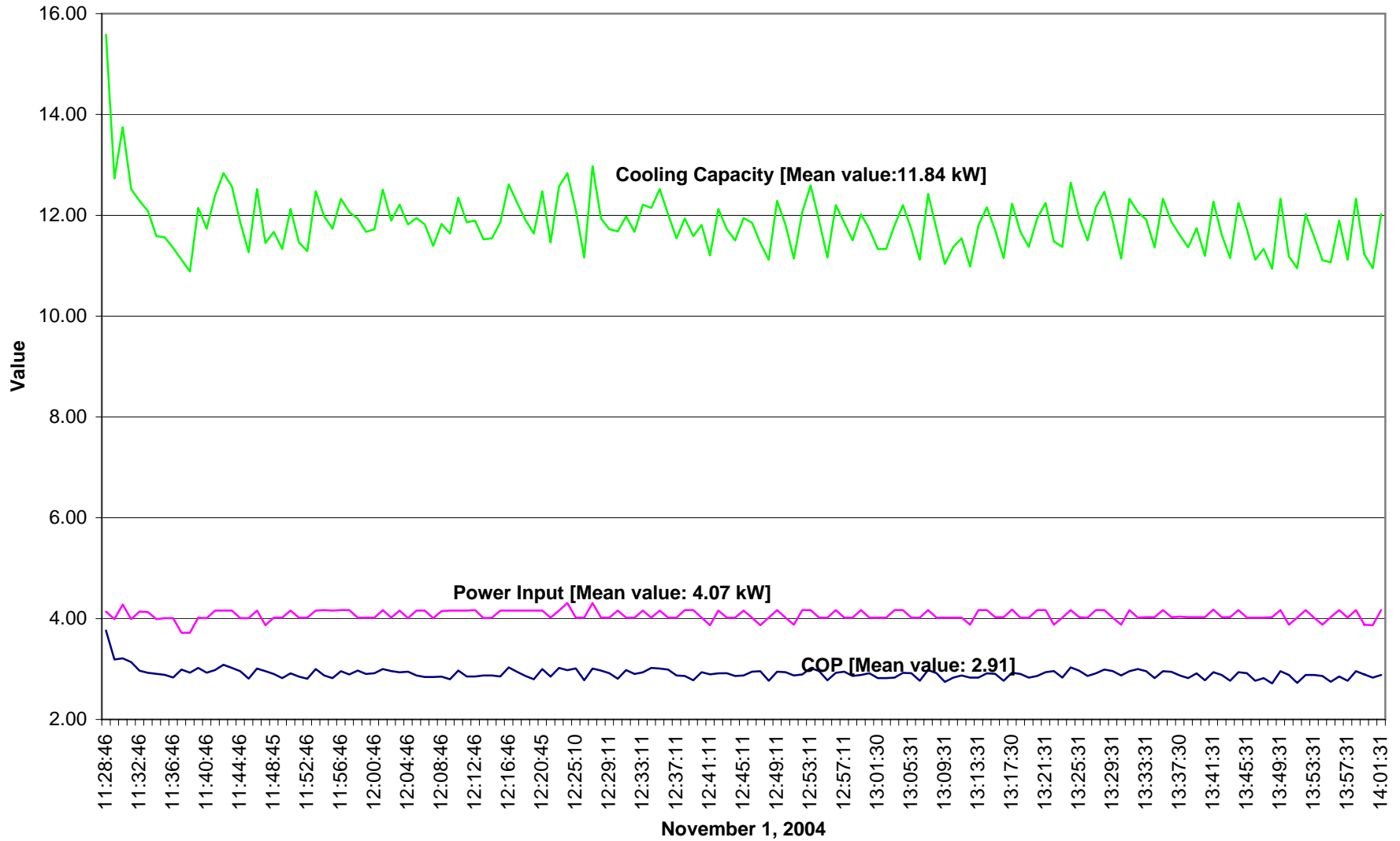


# Post Treatment Test

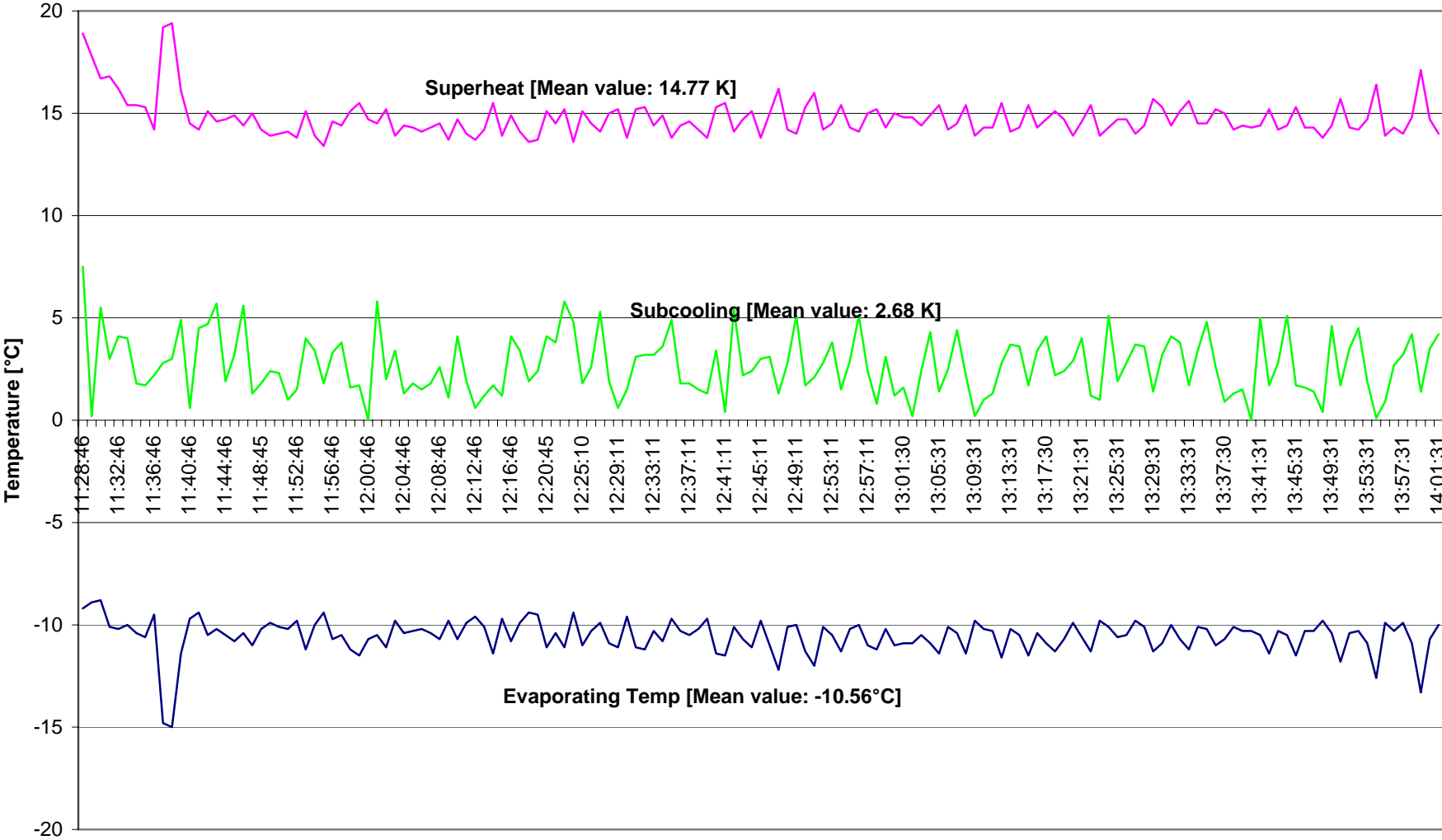
November 1, 2004

Appendix A

**Chart 1B - Galipo Foods Cool Room: Cooling Capacity, Power Input & COP  
[Post-treatment]**



**Chart 2B - Galipo Foods Cool Room: Operating Temperatures (Post-treatment)**



November 1, 2004

**Chart 3B - Galipo Foods Cool Room: Operating Temperatures (Post-treatment)**

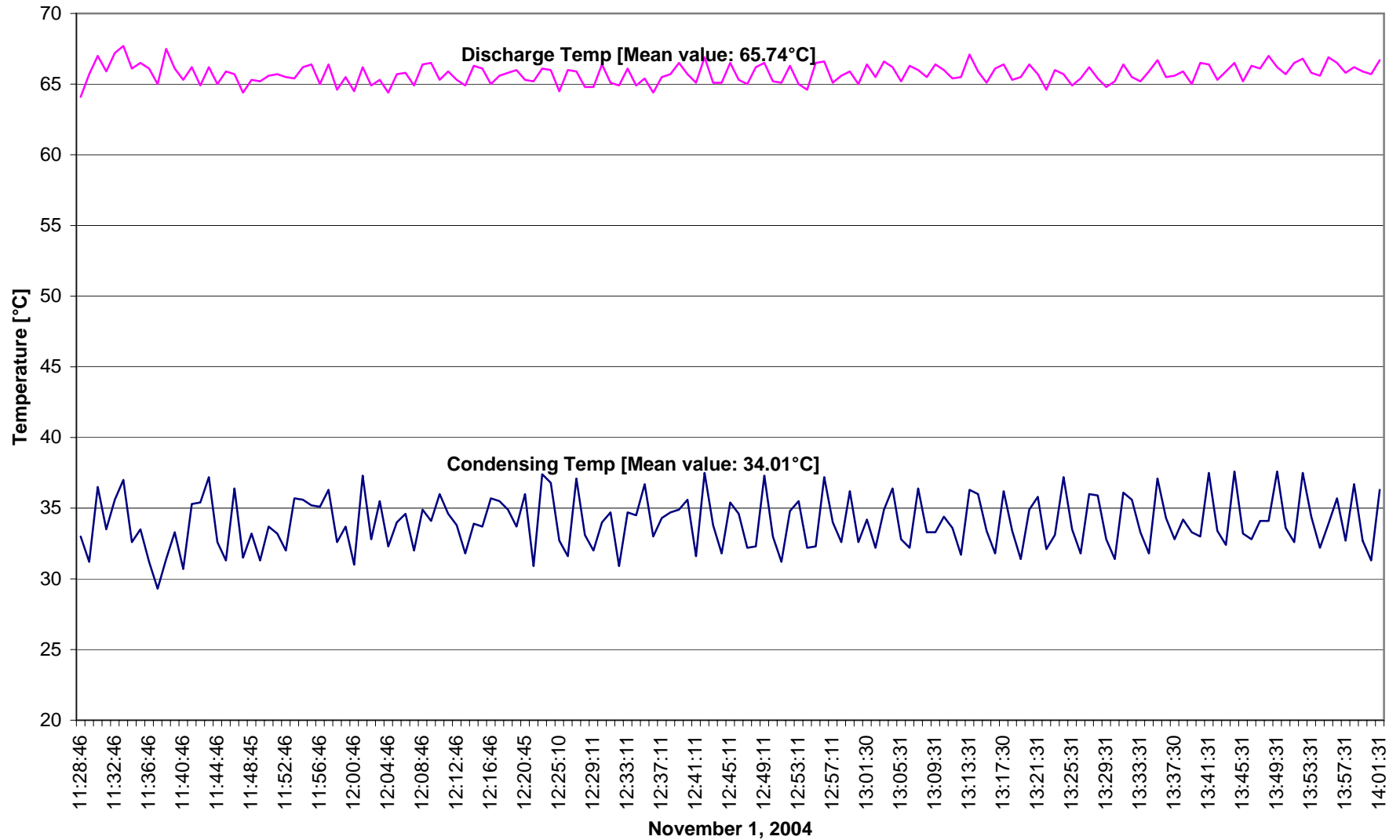
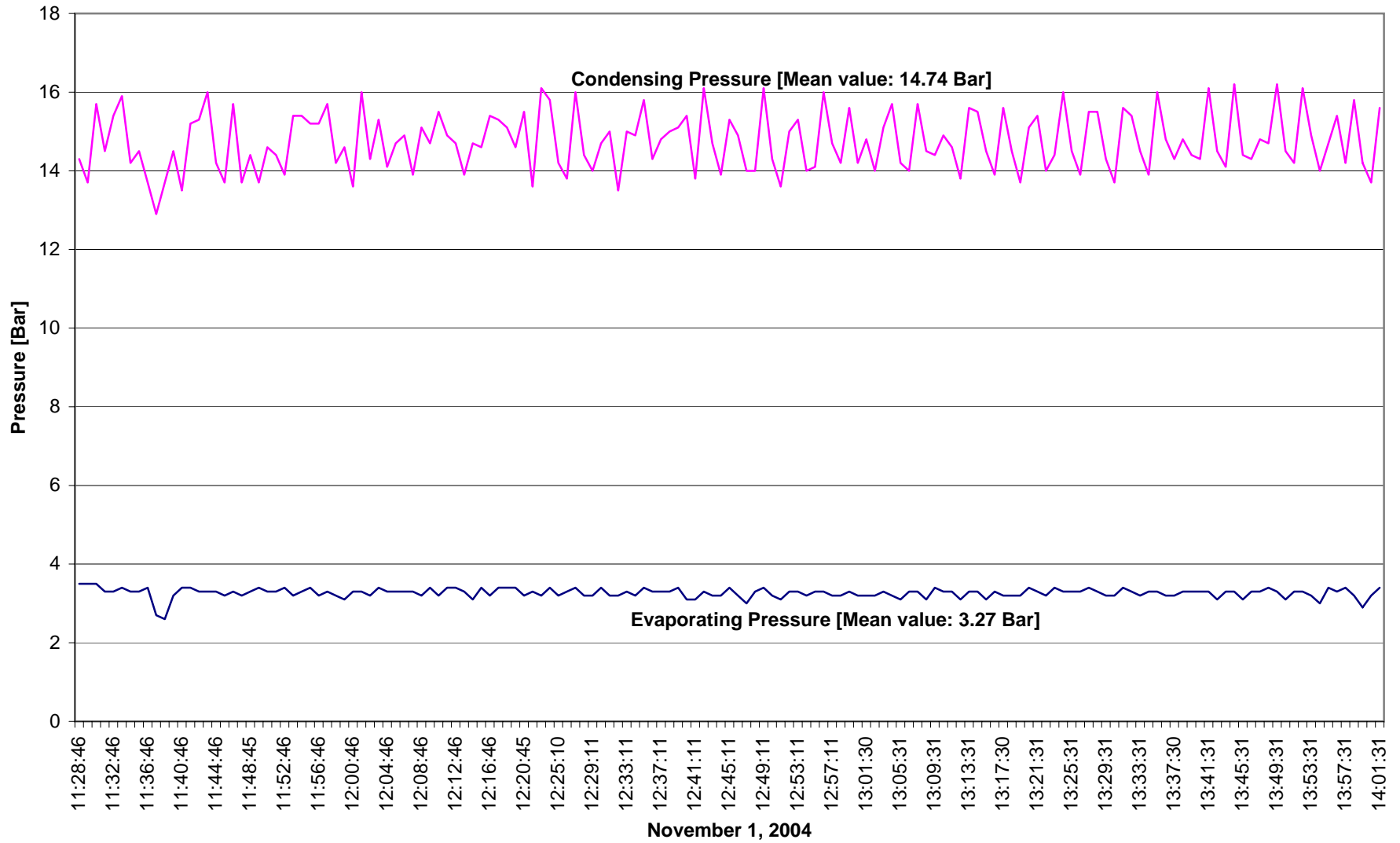


Chart 4B - Galipo Foods Cool Room: Operating Pressures (Post-treatment)

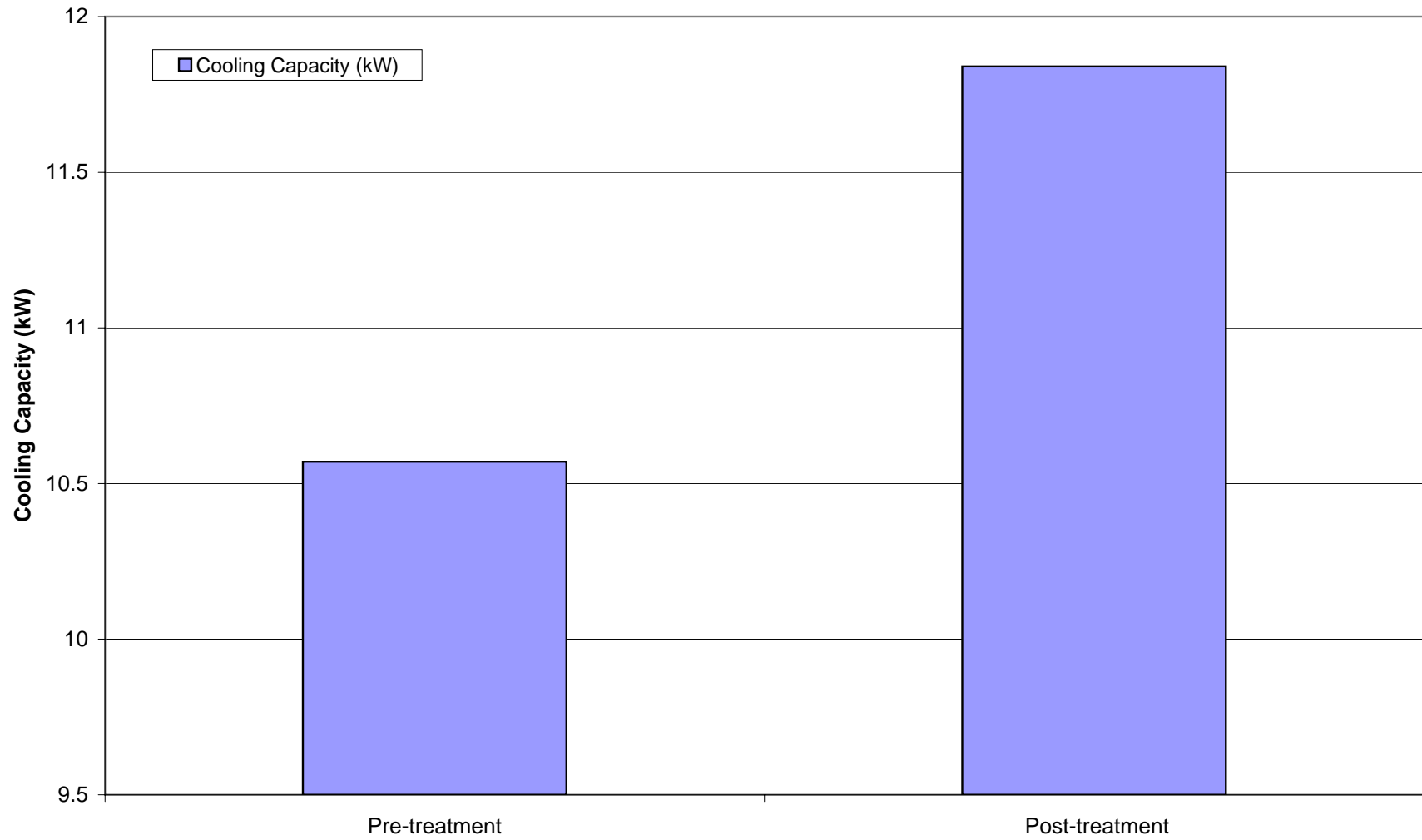


# Performance Comparison

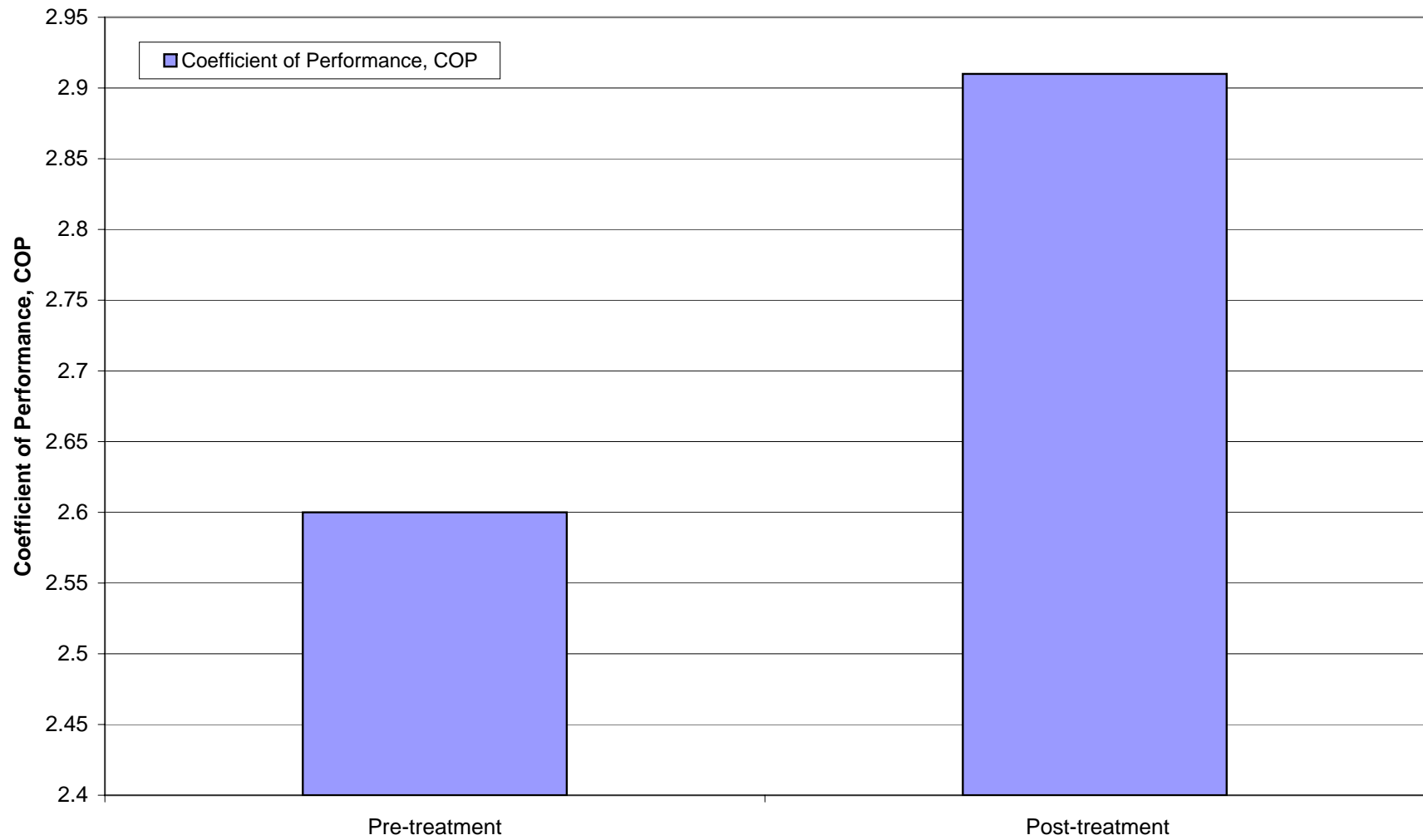
Pre: October 18, 2004  
&  
Post: November 1, 2004

Appendix B

**Comparison of Cooling Capacity resulting from treatment with PermaFrost**



**Comparison of COP resulting from treatment with PermaFrost**



Comparison of Performance of Chiller resulting from treatment with PermaFrost

