

**RESEARCH TOPIC ACCEPTANCE REQUEST**  
**TC/TG10.5 – Refrigerated Distribution & Storage Facilities**

**Title:**

Comparison of Refrigerated Warehouse Dock Dehumidification Techniques

**Research Category:** Refrigeration Systems

**Research Classification:** Basic/Applied

**TC/TG Priority:** 1

**Estimated Cost:** \$75,000

**Other interested TC/TGs:** TC 10.8

**Possible Co-funding Organizations:**

International Association of Refrigerated Warehouses (IARW)

**Handbook Chapters to be Affected By Results of this Project:**

Refrigeration Handbook Chapters 12 and 13

**State-of-the-Art (Background):**

Infiltration of moisture into a frozen food warehouse is costly to the operation of the facility. The infiltrated moisture deposits on the evaporator coils in the form of frost, decreasing the system efficiency. Periodically, the coils must be defrosted to remove the accumulated moisture. To reduce the frequency of this cycle, refrigerated warehouse loading docks are often conditioned to reduce the infiltration of moisture into the freezer. Due to air exchange driven by the temperature difference between the freezer and the dock, the freezer is typically protected from the dock with an infiltration-reducing device (i.e. strip curtain, rapid-action door, air curtain, door vestibule, etc.) and a heat source to prevent frost on freezer surfaces near the door.

Modern cold storage warehouse docks are typically operated in the range of 35°F to 45°F using mechanical refrigeration evaporators. Dock operation has a significant impact on total system energy use. The conditioning of the dock requires energy, but it lessens the energy required to condition the freezer. However, the dock operation that offers the lowest total system energy use is likely dependent on the refrigeration system that is meeting the loads, the presence of a supplemental dehumidifier, and the required heat addition at the freezer door to eliminate “snowing” in the freezer.

Under most ambient conditions, the conventional system is sufficient to prevent the infiltration of significant amounts of moisture into the freezer. In certain instances, particularly in high humidity locations, it may be necessary to supplement the mechanical refrigeration system with a desiccant dehumidifier or an aggressive system to prevent infiltration through the freezer door (i.e. door vestibule, etc.).

### **Advancement to the State-of-the-Art (Justification):**

There is debate in the industry regarding which technology is appropriate and under what conditions. It is also uncertain what the best operating conditions are to apply these technologies. Many variables come into play: ambient conditions, freezer temperature, dock construction, incoming product conditions and evaporator placement. A literature search by members of ASHRAE Technical Committee 10.5 has found very little evidence in support of the use of any technology above the others.

It is proposed to determine the impact of dock conditions on the total system energy use for a range of dock conditioning and freezer door systems at several North American locations under varying ambient conditions and document the benefit/cost relationship for design of future applications in new or retrofit facilities. The impact of this research will impact both the design and operation of refrigerated storage facilities.

### **Objective**

The objectives of this project are:

1. Through the process of literature review, manufacturer contact and other research methods, the contractor shall develop a comprehensive understanding of loading dock dehumidification and infiltration prevention techniques employed by **mechanical refrigeration systems, desiccant dehumidification systems, freezer door vestibules, air curtains and other commercially available methods**. In addition to the engineering aspects of the problem, operational and product requirements must be understood in order to bound the problem.
2. To develop a model of each dock dehumidification and infiltration prevention technique to **determine energy consumption by the device and the consequential effect on the freezer refrigeration system** at varying dock and ambient temperatures and relative humidities.
3. To develop a report that **details optimal operating conditions** for each dock dehumidification and infiltration prevention technique examined during the study, which should also be simplified by the researcher for placement in Chapter 13 of the ASHRAE Refrigeration handbook and the Refrigerated Warehouse Design Guide (ASHRAE 1214-RP).
4. To develop a simplified methodology for **comparing the advantages and disadvantages** of each dock dehumidification and infiltration prevention in various regions of North America and a broad range of electric and gas cost that can be amended to the Refrigerated Warehouse Design Guide (ASHRAE 1214-RP).

The results of this project will be published in Transactions/ASHRAE Journal and incorporated into Chapter 13 of the Refrigeration Handbook.