

SAMPLE ENTRY

CHAPTER/REGIONAL TECHNOLOGY AWARD – SHORT FORM

1. Category (Check One and indicate New or Existing, if applicable)
- | | | | | | |
|-----|---|-------|--------|----------------|----------|
| I | Commercial Buildings | _____ | New or | _____ | Existing |
| II | Institutional Buildings | _____ | New or | <u>✓</u> _____ | Existing |
| III | Health Care Facilities | _____ | New or | _____ | Existing |
| IV | Industrial Facilities or Processes | _____ | New or | _____ | Existing |
| V | Public Assembly | _____ | New or | _____ | Existing |
| VI | Residential | _____ | New or | _____ | Existing |
| VII | Alternative and/or Renewable Energy Use | _____ | New or | _____ | Existing |
2. Name of Building or Project: Freshwater Institute – Environmental Control Rooms
City/State: _____
3. Project Description: Refrigeration System Design for Environmental Control Rooms
- a) Project Study/Design Period: 2001 – 2002
- b) Has the project been completed (Y/N): Yes
If YES, date completed: Phased Completion 1995 to 1998
- c) If NO, scheduled date of completion (or other explanation): _____

4. Entrant (ASHRAE member with significant role in project. If multiple entrants, each must sign and provide information below):
- a) Name: _____ Chapter/Membership #: _____
Name: _____ Chapter/Membership #: _____
- b) Address: _____
- c) Telephone: _____

- d) E-mail: _____
- e) Company: _____
- f) Title: _____

- g) Member's Role in Project: _____

- h) Member's Signature: _____ Date: _____
_____ Date: _____
5. Engineer of Record: _____

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the Owner and have received permission from the Owner to submit this project to the ASHRAE Technology Awards Competition.

FRESHWATER INSTITUTE

The Freshwater Institute is a scientific research facility engaged in the study of fresh water ecosystems. The facility was built in 1972 and is located on the campus of the University of Manitoba. In 1995 a project was developed to replace refrigeration systems serving a series of environmental control chambers at the Institute. The new refrigeration systems combine standard practices from retail food store refrigeration systems with multiple evaporators and the programmable control systems used in environmental control chambers.

The Institute performs research on ecosystem environments using environmentally controlled rooms and cabinets. Temperature and humidity are controlled in these rooms by vapour compression refrigeration systems along with electric heaters and electric humidifiers. The performance capabilities of the original systems were based on retail food store technology available at this time. However, development of packaged environmental chambers, programmable electronic controls and PID control loops represented new standards for range and tolerance of temperature and humidity control demanded by the scientific community. Space limitations and room structure replacement costs ruled out pre-manufactured equipment, thus requiring custom designed refrigeration systems using the existing environmental control rooms.

The user's specifications for the environmental control rooms included the following design criteria:

1. Narrow temperature control tolerance within each room $\pm 0.5^{\circ}\text{F}$.
2. Variation of temperature control over a wide range to allow research projects over a full range of controlled temperatures, with individual space temperature ranges from 15°F to 105°F .
3. Utilize remote condensing units to facilitate maintenance in an accessible location.
4. Use non CFC and non HCFC refrigerants.
5. Provide 100% back up systems for all environmental control rooms and chambers.
6. Provide complete monitoring of temperature and humidity in each space along with alarm indication.

The project included replacing 10 refrigeration systems serving 24 environmental rooms. Two types of refrigeration systems were provided: medium temperature systems utilizing R404 refrigerant for room temperature range of 15°F to 50°F and high temperature systems utilizing R143a refrigerant for room temperature ranges above 40°F .

APPLICATION OF ASHRAE TECHNOLOGY AWARD CRITERIA

1. Energy Efficiency:

This project does not present energy reduction measures beyond current standards. Standard practice in environmental control rooms is to use hot gas bypass control for compressors to provide stable operation and prevent short cycling, resulting in continuous compressor operation and associated inefficiencies.

2. Indoor Air Quality:

Not applicable, environmental control rooms simulate outdoor conditions.

3. Innovations:

The project uses refrigeration system practices taken from retail food store refrigeration and applies them to environmental control chambers used in scientific research. The project features multiple evaporator refrigeration system with wide range of evaporator loads, wide range of evaporator temperatures, temperature control stability and temperature accuracy. A DDC control system allows remote programming of environmental control rooms and scheduled temperature and humidity variations within the room.

4. Operation and Maintenance:

Operation is facilitated by the DDC system allowing full programming and setpoint adjustment from a remote location as well as central monitoring and alarm functions. Maintenance is facilitated by locating remote condensing units in accessible locations and by the reduction in condensing units with multiple evaporator systems.

5. Cost Effectiveness:

To meet the user's program two options were identified:

- A. Replace the environmental control rooms with package environmental chambers, or
- B. Reuse existing room structures and replace refrigeration systems to expand temperature range along with DDC control.

The second option was selected as the lower cost solution.

6. Environmental Impact:

The project reduces risk to the environment by replacing original R-12 and R-22 refrigeration systems with R404 and R134a respectively. In addition, the selected design reuses existing environmental control room structures, thus avoiding solid waste disposal of these components.