East Grand Forks

Ice Arena Review &
R22 Refrigerant Phaseout

Introduction

- Under the U.S. Clean Air Act, the United States is phasing out the production and import of HCFC's including HCFC 22 in an effort to protect the stratospheric ozone layer.
- HCFC 22 (or R22) refrigerant, used in the Ice Plant at the Civic Center & VFW Arena, is on the EPAs banned list to be removed from production and import beginning on January 1, 2020.
- This ban does not mean that HCFC R22 will no longer be able to be used after 2020, but the supply will eventually become lower, and the cost to purchase refrigerant will likely be increased.
- In addition, equipment for the ice plant in use in our arena's will become more limited.

Basic Definitions of Ice Rink Operation

- Ice system:
  - A term used in totality describing the ice plant skid, ice floor system, head piping, header trench(s), heat recovery and HVAC&R energy saving components and dasher board systems. The ice system typically includes the concrete slab, sand, insulation, and other materials encompassing the under-floor system.
- Ice Plant/Skid:
  - The equipment located in the machine/mechanical room connected to the rink floor systems that generates heat transfer.
- Rink Floor
  - The concrete slab, cold floor piping, insulation, vapor retarder, sand and sub-floor heating system.
- Indirect System
  - An indirect system uses two refrigerants. The primary refrigerant is contained in the equipment machine room. The secondary refrigerant is circulated in the rink floor piping. The heat exchange occurs in the equipment machine room.
- Direct System
  - A direct system circulates the primary refrigerant directly through the ice rink floor piping within the sand/concrete floor structure. There is no secondary solution of either glycol or calcium chloride in this type of system.

Summary of East Grand Forks Indoor Ice Arena's

- Ice Arena's currently managed by the Parks & Recreation Department
  - Civic Center, opened in 1974
  - VFW Memorial Arena, opened in 1982
  - Blue Line Club Arena, opened in 2008

- In the spring/summer of 2017, the City contracted CIMCO Refrigeration to conduct an Arena Systems Review of each of the three ice arena's, to provide a professional opinion on the current ice plant systems in each building, as well as a preview of any required R22 replacement.

Civic Center

- Building has gone under multiple structural updates and remodel's through the years.
- 1993 – Rink Floor Replacement
- Ice system is an "In-direct" R22 Compressor, carrying about 400 lbs. of R22
- Ice plant has had some updates to equipment of the years, while some remain original with the building.
- One area designated as a concern by CIMCO review are the aged chiller barrels.

CIMCO Comments & Analysis

- System is tired and aged, with portions of system (chillers) dated back to original system
- Controls & infrastructure is past its useful life
- Heat Reclaim and AHU can be retrofitted and repurposed to provide significant value and savings
- Fluid coolers seem undersized, as evidenced by issues with plant operation is warmer ambient temperatures
- Existing Floor and brine system seem in decent shape, and could be retrofitted with new package
- R22 is being phased out, and pricing and availability will cause issues in coming years
- Compressor and mechanical room located in lower level are not up to date with current code for leak detection, emergency shut-off, emergency exit, etc.

CIMCO Recommendations for Civic Center

- Remove and replace existing R-22 based refrigeration system with a new ammonia based primary, brine (calcium chloride reused secondary) system
- A new outdoor pre-fabricated ice plant room will be required to house a new ice plant as the existing basement room does not meet code and access for ingress of new skid system is not possible.
- Demolish existing fluid coolers to make way for location of new prefabricated engine room
- Re-pipe and re-purpose the heat reclaim system and re-using and re-wire the AHU and electric heater system and connect to the new ice plant and room
- Re-purpose the old engine room into storage or other use

Suggested Replacement of Refrigeration package with re-used ice floor:

- $1.4 million

VFW Memorial Arena

- Built in 1982
- Ice Plant is a direct-flooded R22 floor, with an estimated 4,000 to 5,000 lbs. of R22.
- Ice plant was replaced in 1997, with a used package from another arena.
- Piping running through rink floor is original with building
  - *Estimated life span of direct R22 floor is 25 years. Current ice floor is 37 years old.*
- VFW Arena has many additional areas of deferred maintenance which should be addressed, along with ice system.

CIMCO Comments & Analysis

- CIMCO review provided a number of attainable short-term improvements to allow VFW Arena to have an extended lease on life. Many of those improvements have been made over the last year and a half, including overhauling a compressor.
- Many aspects of the ice system are at risk of breaking down at any time, with timeline for replacement parts being a large unknown.
- R22 is being phased out, and pricing and availability will cause issues in coming years
- Building and compressor room are not up to date with current codes for leak detection, emergency shut-off, emergency exit, etc.

CIMCO Recommendations for VFW Arena

- Prepare a medium to long term goal of total replacement of the existing rink floor and ice plant to a Direct Overfed Floor- Pumped Co2 system. Co2 Direct will maintain the quality ice you and your clients have come to expect and appreciate
- All of the infrastructure, regardless of primary and secondary refrigerants will need to be demolished and replaced with a change in refrigerant
- Co2 is the ultimate GREEN gas with Zero (0) GWP Global warming potential and Zero (0) ODP Ozone Depletion Potential Co2 is the most efficient of the gases for your seasonal use, northern locale and arena engine room location, size and physical dimensions
- In the interim (2-5 years) retrofits to the existing refrigeration skid and system as follows:
  - Re-build second Gram compressor

Suggested Replacement of Refrigeration package with re-used ice floor:

- $2.2 million

Additional VFW Arena Projects/Deferred Maintenance

- Two Boilers
  - used to heat building are in need of replacement
- Roof over main part of the building
  - areas of the roof has leaked in warmer temps this winter and it has been indicated that many of the screws are rusted out. Further assessment should be done in summer 2019.
- Signage
  - Old neon light sign doesn't work, and isn't feasible to fix. Replacement estimate is $15,000
- Accessibility
  - Building is not considered to be ADA compliant. Restrooms are one area that need attention in this area
- Building Code
  - Building in some cases is not current with today's codes. One example, there is no fire alarm system in the building
- Parking Lot
  - Asphalt is aging, has had patching done in recent years, and may be in need of an overlay in the coming years

Blue Line Club Arena

Blue Line Club Arena

- Artificial Ice installed in 2008
- Twin R404a Refrigerant compressors with a Glycol cooled floor.
- One Compressor replaced in 2018

CIMCO Comments & Analysis

- Current R404a refrigeration is on EPA Hit list for NEW systems, but can still be produced and used.
- No need to convert refrigerant at this time.
- Compressor room is not up to date with current code, mssing a refrigerant lead detector, ventilation systems, emergency shut-off, etc.
- Recognized concerns with the building do include:
  - Concrete floor does have some cracking/heaving taking place.
  - Building has no heat reclaim system and has poor ventilation.
  - Future forecasted price of R404A is an unknown as it moves up the chain of the EPA hit list.

Suggested replacement cost for ice rink floor slab:

- $600,000

CIMCO Recommendations for BLC Arena

- Continue using R-404A gas until price rises exponentially or is no longer available before switching out to a new refrigerant
- Consider further analysis of testing of insulation and frost penetration beneath floor slab is suggested
- Should floor slab cracking/heaving continue beyond repair, floor slab may need to be replaced.

Suggested Replacement cost of ice rink floor slab, should replacement be needed:

- $600,000.00

Next steps for our Arenas?

- Comprehensive Building Study
  - Review all original building information, drawings, specs, etc.
  - Perform analysis of building studies and reports
  - Draft and review with staff the building study
  - Prepare a Capital Improvement Plan for all three arena's
    - *What vision do we have for future use of our arena's?*
- Feasibility Report
  - To determine the feasibility of making improvements to our arena ice systems and arenas in general
  - Provide recommendations to the City of East Grand Forks for improvements

Decision Points for discussion

- Will Ice System projects be phased or completed all at one time?
- If phased, which building is of highest priority for completion?
- Would the City Council like to see a Comprehensive Building Study and/or Feasibility Report completed?
- What is the total project budget and how will it be funded?

Questions?