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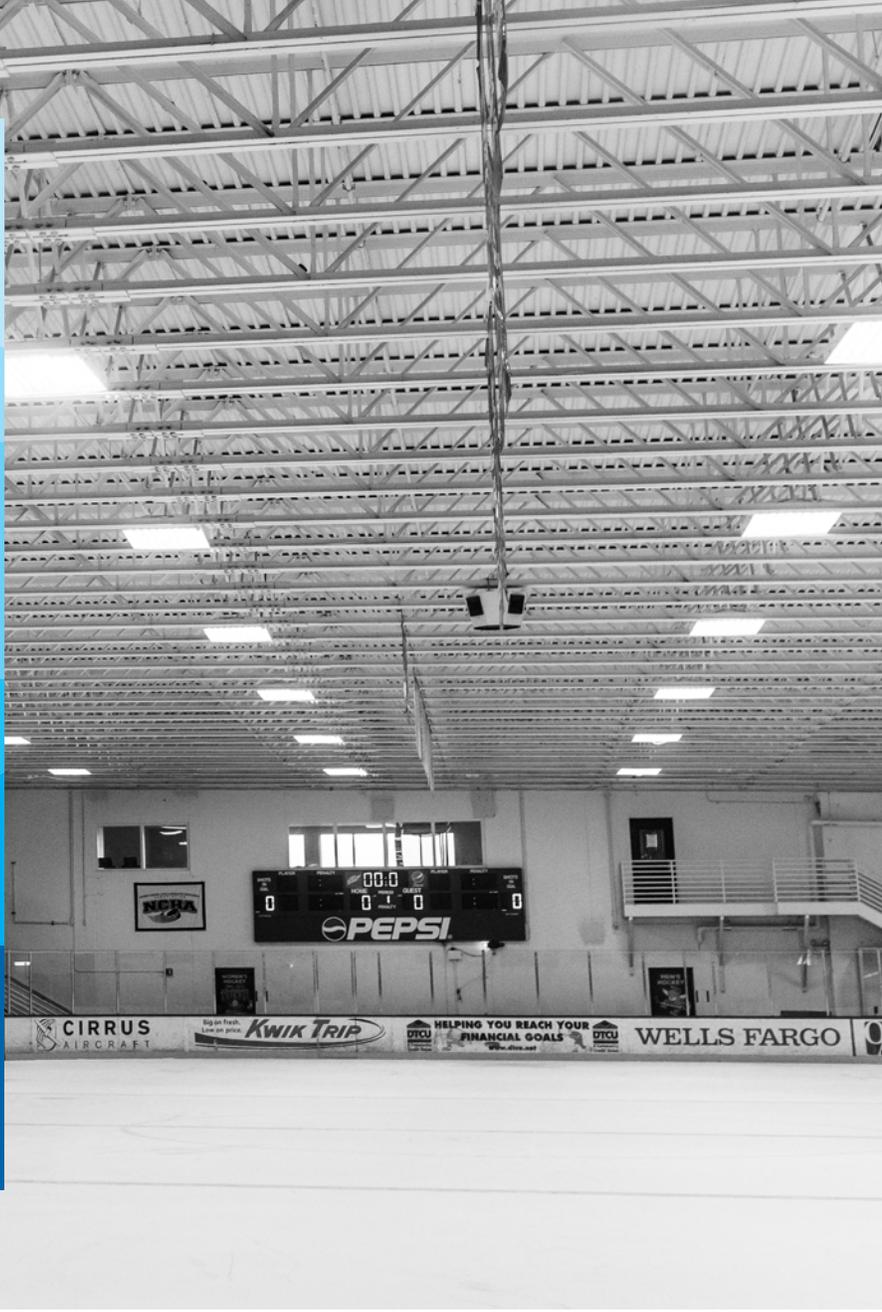
for better

## R-22 Phaseout Spurs Proactive Refrigeration System Upgrade

St. Cloud Refrigeration converts Mars Lakeview Arena in Duluth, Minnesota, to Chemours non-ozone depleting, low global warming Opteon™ XP40 (R-449A) refrigerant



Opteon™



“There are approximately 4,800 indoor ice rinks in North America with an average age over 30 years.”

—NHL®

<https://www.nhl.com/info/nhl-green/greener-rinks>



Situated in Duluth, Minnesota, the Mars Lakeview Arena had been supporting a full-size ice sheet with its original 1999 flooded chiller system charged with 1,750 pounds of R-22. “Although the system ran for some time without needing to have refrigerant added, we knew the potential was there to have a leak sometime down the road, requiring us to add more R-22 to the system. This could get costly for our client, given the phaseout of R-22 in the near future. So, we raised the idea of a retrofit to find a long-term plan to get away from R-22,” said Justin Zembo, lead mechanical technician from St. Cloud Refrigeration (SCR).



## Mars Lakeview Arena at a Glance

- Privately owned and operated ice skating arena
- Located in Duluth, Minnesota
- Built in 1999
- Provides 3,500 hours of ice time to approximately 120,000 patrons each year
- Serves Division 3 college hockey teams, high school hockey teams, the Duluth figure skating club, and the general public

Brendan Flaherty, the rink's executive director, continued,

"We really weighed our options when deciding to replace the R-22 that we had been using in our chiller with Opteon™ XP40. Ultimately, Opteon™ was more cost-effective for us than ammonia or other options, and we saw very early success. The ice quality has been as good or better since the conversion."

Like many community rinks, Mars Lakeview Arena operates year-round and is a social and cultural hub for area residents. It serves Division 3 college hockey teams, high school hockey teams, the Duluth figure skating club, and the general public. The rink provides over 3,500 hours of indoor ice time to approximately 120,000 patrons each year.

After the arena received a Mighty Ducks grant, the rink's executive team, led by Flaherty, decided to make some much-needed and eco-friendly facility upgrades. In addition to the chiller retrofit, the arena purchased an electric Olympia ice resurfacer and a new dehumidifier system. The converted direct expansion (DX) chiller system runs on a non-ozone depleting, low global warming potential (GWP) refrigerant from Chemours called Opteon™ XP40 (R-449A). The refrigerant is a hydrofluoroolefin (HFO) blend that has zero ozone depletion potential (ODP) and provides a 23% reduction in GWP over R-22. The arena partnered with technical experts from SCR and The Chemours Company to discuss equipment and retrofit options.

## Conversion Process

After discussing retrofit options for the rink, SCR began planning, ordering, and assembling the necessary equipment in December 2016.

### Opteon™ XP40 Properties

	XP40	HCFC-22
ASHRAE Designation	R-449A	R-22
ASHRAE Safety Classification	A1	A1
Ozone Depletion Potential	None	0.05
Global Warming Potential	1282	1810
Boiling Point at 1 atm	-50.7 °F	-41 °F
Liquid Density at 70 °F, lb/f <sup>3</sup>	69.5	75.3
Lubricant	POE	Mineral Oil

For further data on the properties, uses, safety, and handling of Opteon™ XP40 (R-449A), please visit [www.opteon.com](http://www.opteon.com).





Early April 2017 was selected for the retrofit to accommodate the rink's schedule, and SCR planned each detail in advance. On a Sunday evening, SCR began recovering the R-22 and drained the system's secondary coolant, glycol. Next, SCR removed the flooded R-22 chiller barrel and replaced it with a DX chiller barrel designed to run on Opteon™ XP40. They also drained the mineral oil out of the system and replaced it with polyolester (POE) oil. The elastomeric seals and O-rings in valves and other parts of the system were also replaced as a precaution against future leaks.

The chiller's controller had been upgraded to a digital control system a few years prior to the retrofit. In order to monitor the system's performance with the XP40 refrigerant, SCR added more sensors on the compressors to monitor temperatures and pressures, and installed others on the chiller barrel itself. They also placed sensors on the glycol side to better monitor flow. Finally, SCR updated the existing leak detector settings to monitor for the new refrigerant.

With the retrofit complete, the new system's footprint in the mechanical room is smaller. The new evaporator is shorter because the old one had a surge drum on top that used to reach the ceiling. "The old system had a lot of flanges and connection points, which increased the potential for leaks. The new system is a much more streamlined design," explained Zembo. The old system also required an oil pot that had to be checked and manually drained, but now with the new DX barrel, the rink doesn't require that kind of maintenance anymore.

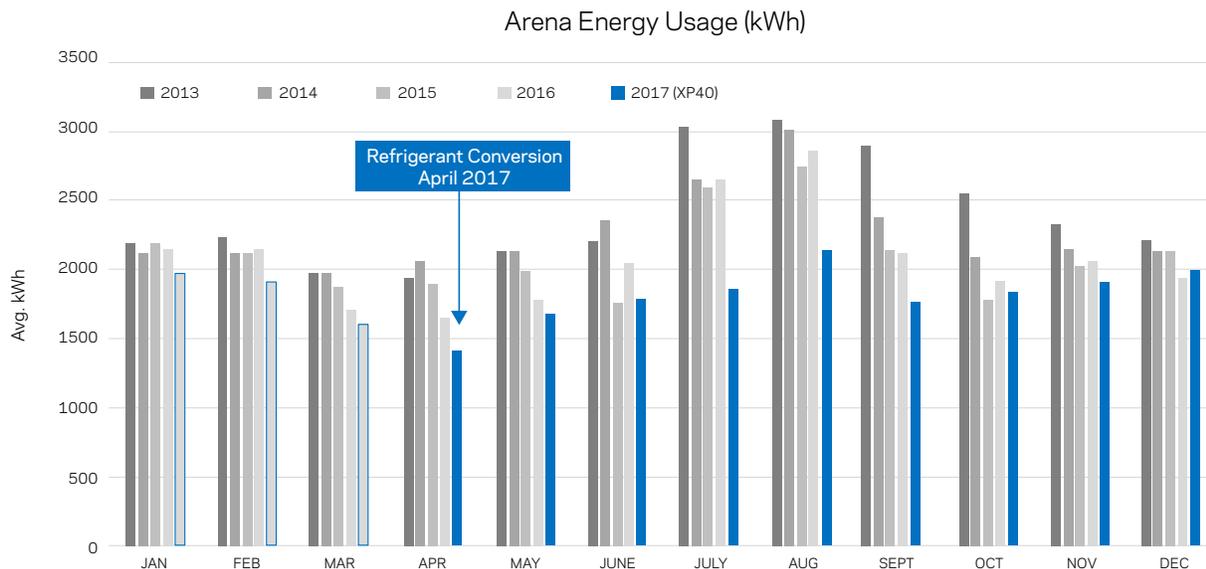
"This job was really successful because we planned every detail in advance," said Zembo. He added, "The chiller ended up being shut down for only five days, although they had planned for a full week of downtime."

## Operational and Energy Efficiency Performance

Brendan Flaherty is happy with the new system. "The ice sets up very fast now and our whole system is more digital, so SCR can monitor it from their offices—this saves us from having to worry about anything." Arena staff and ice rink patrons have also reported excellent ice quality.

Interestingly, the new system is charged with just 950 pounds of R-449A versus the 1,750 pounds of R-22. This smaller charge size doesn't affect the performance of the system, but it does have several benefits. First, it provides some up-front cost savings to the rink and the contractor because they're buying less refrigerant. Second, in the event of a leak, there would be a lower risk of environmental impact because there is less overall refrigerant. Finally, the total climate impact potential of the system goes down not only because of the lower GWP of the refrigerant itself and the fact that there is less of it, but also because the new system uses less energy.

While many factors contribute to improvements in energy efficiency, and SCR cannot guarantee its clients energy savings in every case, Mars Lakeview Arena saw an average reduction in its facility electrical usage of ~16% in the six months immediately following the refrigeration system upgrades compared to the previous year.



Justin Zembo also reports that in the year since the retrofit occurred, SCR has not detected any leaks. There were some small leaks over the years with the old R-22 system.

## Conclusion

The refrigeration system for Mars Lakeview Arena's ice rink was successfully converted from R-22 refrigerant to low GWP refrigerant Opteon™ XP40 (R-449A).

Justin Zembo explains, "While Mars Lakeview Arena could potentially go to an ammonia system, in that case they'd be replacing everything in the room." He added, "They'd also end up spending a lot more money and having a lot more business disruption and downtime for the rink."

"XP40 was a great option. I don't know of a lower GWP option that would have still used as many of the same system components as we did."

—Justin Zembo, SCR Team Leader

Brendan Flaherty agrees: "We're really proud of our focus on sustainability and we were fortunate to have good guidance from SCR. It's a relief not to have to worry about the R-22 anymore. I highly recommend doing a retrofit as an alternative to an entire system replacement—they had the conversion done within a week. It didn't take long and it wasn't invasive," Flaherty concluded.

**For more information on the Opteon™ family of low GWP products, visit [optforbetter.com/NHL](http://optforbetter.com/NHL)**



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