AGENDA
CITY OF CREVE COEUR
FACILITIES TASK FORCE
300 NORTH NEW BALLAS RD
COUNCIL CHAMBERS
NOVEMBER 7, 2022
9:00 AM

CALL TO ORDER

ROLL CALL

APPROVAL OF MINUTES

1. **Approval of June 13, 2022 Facilities Task Force Meeting Minutes**

DISCUSSION ITEMS

2. **Discussion of Ice Arena Structure**

ADJOURNMENT

Posted by: ______________________

Date/Time posted: ______________________

If you need special accommodations to attend a meeting, services may be arranged by contacting the Office of the City Administrator in advance.

REGULAR MEETING
MINUTES
CITY OF CREVE COEUR
FACILITIES TASK FORCE
300 N. NEW BALLAS ROAD
JUNE 13, 2022
4:00 PM

CALL TO ORDER

A regular meeting of the Facilities Task Force of the City of Creve Coeur was called to order by Chair, City Council Member Joseph Martinich at the City Council Chamber, 300 North New Ballas Rd, City of Creve Coeur Government Center, Creve Coeur, MO 63141 on Monday, June 13, 2022 at 4:00 PM.

Mayor Robert Hoffman
Chair, City Council Member Joseph Martinich
Member Marjorie Richter
Member Richard Darrow
Member Barry Glantz
Member Richard Kutta
City Council Member Tim Carney

Staff Present: City Administrator Mark Perkins, Director of Public Works Jim Heines and City Clerk Kellie Henke.

Also Present: Jen Kissinger, Navigate Building Solutions, Roy Mangan, Archimages, and Joe Buehler, Horner & Shifrin Engineers.

II. APPROVAL OF MINUTES

1. Approval of March 25, 2022 Facilities Task Force Regular Meeting Minutes

RESULT:	**ACCEPTED [UNANIMOUS]**
AYES:	Hoffman, Martinich, Richter, Darrow, Glantz, Kutta

III. VICE CHAIR

Chair Martinich called for nominations for Vice Chair. Mayor Hoffman moved to elect council member Tim Carney as Vice Chair, seconded by Barry Glantz.

Motion to Elect Council Member Tim Carney as Vice Chair

RESULT:	**APPROVED [UNANIMOUS]**
MOVER:	Robert Hoffman, Mayor
SECONDER:	Barry Glantz, Member
AYES:	Hoffman, Martinich, Richter, Darrow, Glantz, Kutta

The vote on the motion being 7 ayes and 0 nays, motion carried.

IV. GOVERNMENT CENTER ANALYSIS UPDATE

Jen Kissinger with Navigate Building Solutions and Roy Mangan with Archimages provided an update on the Government Center feasibility study including objectives, processes, concepts and cost estimates (see Exhibit A).

Mr. Mangan stated the feasibility study focused on three different solutions and continued to discuss each one. Each solution centers around customer service, security, staff efficiency, code compliance, energy conservation and growth potential; each offering different a building lifecycle.

-Adaptive Re-Use: $7-8 Million Project Cost; 5–8-year lifecycle
-Partial Demo/Renovate: $15-17 Million Project Cost; 20–25-year lifecycle
-New Construction: $20-24 Million Project Cost; 50+ year lifecycle

Richard Kutta asked how the 25% market contingency was determined, to which Jen Kissinger stated it is reflective of the market for the past six months. Labor shortages, increased material costs and availability are driving the current market.

Mayor Hoffman asked what financing options are available, to which Mr. Perkins stated that multiple revenue sources could be used but that most likely any scenario would need to include a general obligation bond issue.

Ms. Kissinger recommended determining which option is the best solution and move towards a schematic level design.

Chair Martinich stated there is no time pressure for making this decision, but likes the idea of a new building. Mr. Martinich stated not all funding would need to be through a bond issue and suggested a three-year plan so that the city can put the use tax on the ballot, which may result in additional revenue if passed, pay down the police station, and set any additional revenues aside. Mayor Hoffman agreed.

Margie Richter stated the removal of the gymnasium may receive push back, however agreed that a new building may be the best solution.

Barry Glantz stated the community may not be as supportive for a new building, but agreed that there is no rush for this decision to be made.

Mr. Kutta asked if there are any potential maintenance disasters currently at the Government Center, to which Jim Heines stated patching is needed for the roof and a monitoring system for the HVAC is also needed.

Mr. Glantz stated a long-term plan would be beneficial and suggested working towards the schematic plan design while seeking community feedback.

Richard Kutta moved to continue investigation of a new building through schematic design, second by Mayor Hoffman.

Motion to Continue investigation of a new building through schematic design

RESULT:	**APPROVED [UNANIMOUS]**
MOVER:	Richard Kutta, Member
SECONDER:	Robert Hoffman, Mayor
AYES:	Hoffman, Martinich, Richter, Darrow, Glantz, Kutta

The vote on the motion being 7 ayes and 0 nays, motion carried.

The meeting adjourned at 5:20 PM.

Request for Qualifications

Ice Arena Refrigerant System Replacement

Engineering Services

Project #:	**200E**
RFQ Issued:	**Tuesday, August 30, 2022**
Submittal Due Date:	**Friday, September 23, 2022 @ 4 p.m. CDT**

City of Creve Coeur, MO
Public Works Department

REQUEST FOR QUALIFICATIONS

The City of Creve Coeur Ice Arena is located at the Dielmann Recreational Complex (11400 Olde Cabin Road) south of Olive Blvd. in the north central portion of Creve Coeur, Missouri. The facility has a long tradition of ice hockey, ice skating, and curling. The highest level of play at this facility is high school practices. High School games are not played at the facility due to the limited seating. Public and private sessions for all ages, as well as Learn to Skate group lessons are also offered for residents and nonresidents.

The Creve Coeur Ice Arena uses a refrigerant system to cool the concrete slab beneath the ice sheet to allow the sheet to freeze and remain as ice. A layout of the system is shown on Attachment #1. An evaluation of this system was completed on February 15, 2021 (See Attachment #2 for the report). The findings included that the existing system is a 19-year-old plant that is past its prime and uses refrigerant (R-22) which is no longer produced, environmentally unfriendly, difficult to find, and costly to replace. All associate system components are nearing the end of their lifecycle and are not compatible with any subsequent refrigerant chosen. Photos that show the existing conditions of the system are also included with this document (See Attachment #3). Based upon these findings, the City hired a team of consultants for conducting a refrigerant change feasibility study completed on November 4, 2021 (revised on April 5, 2022 – See Attachment #4 for the report). The results of this study outlined options and levels of expenditure for the City's planning of capital improvements for the Ice Arena.

The Public Works and Recreation Departments are soliciting qualifications from engineering consulting firms to review and evaluate the Ice Arena refrigerant system and develop a final recommendation for the feasibility of refrigerant change. The selected engineering firm or group will then design the recommended system and provide all the necessary documents to bid its construction/installation. The firm is expected to have a local design professional in the St. Louis area to support the proposed consulting work and be accessible to the City staff for meetings and field discussions. As an option, the firm will be expected to provide engineering support during construction and, upon completion, commission the new system for its intended safe and efficient use including training the Recreation Department operations personnel, as well as first responders, as needed. The City has also applied for a St. Louis County Municipal Park Grant to fund a part of the capital investment needed for the project. If grant funding is approved, the engineering consultant will work as part of the team to manage the grant requirements and provide the needed documentation. The balance of the project expenditures will come from the City funds. In their work, the consultant will appear as an expert before the City's Facilities Task Force and City Council and provide these bodies with technical and financial recommendations.

Anticipated Scope of Services:

The proposed project would replace the entire Ice Arena refrigerant system, which may include but not limited to the motor control center, evaporative condenser, pumps, motor controls, etc. The scope excludes the concrete rink slab. A two-part study scope (in the interest of timeliness of project delivery the city intends to award both parts to the successful firm out of this solicitation) is outlined with sample tasks listed under each phase for guidance in the development of consultant qualification submittals as follows:

Part I – Evaluation and alternatives feasibility analysis:

- Attend kick-off meeting with City Project Manager and other City team members.
- Review the two prior studies completed for the project (Murphy Evaluation Report dated February 15, 2021, and Chiodini-B32 Feasibility Study dated November 4, 2021-revised April 5, 2022).
- Perform on-the-ground condition assessment of the existing system, its components, and the facility general arrangements and operation.
- Develop detailed analysis and technical review of feasible options for a replacement system, including their estimated cost and implementation timeline.
- Coordinate with City staff findings and results of analysis with a final recommended option for selection.
- Present selected option to Task Force, as needed.
- Revise document per review comments from staff.
- Make final presentation to City Council for approval consideration of the selected option.

Part II – Design and bidding of the replacement system:

- Develop process, mechanical, electrical, piping, instrumentation and controls, fire protection, structural and all other plans, drawings, specifications, estimates, narratives, spreadsheets, calculations, reports, and other elements of the replacement system design as required for project bidding and construction.
- Propose a detailed design development schedule that will plug into the anticipated project implementation schedule (please refer to the section titled "Timeline of Submittal and Contract for Services")
- In cooperation with City Staff, review the design at 45% and 90%, or equivalent completion levels and coordinate any needed input and approvals for progressing onto the next level.
- Generate a conceptual cost estimate and project implementation schedule at each review level.
- Evidence local, State and Federal regulatory compliance for the proposed system design and work with the regulatory officials including the Chief Building Official and Fire Marshal to amend the design as needed (please refer to the section titled "Important Considerations" for additional reference)
- Assist City Staff with responses to Requests for Information during bidding, evaluate bids, and develop an award recommendation for the project construction contract.

Optional construction phase services:
- Construction engineering limited support (review of shop drawings, responses to Requests for Information, technical support for regulatory and code inspections, review and advise on change order requests and construction claims, technical support for final inspection/closeout)
- Commission the replacement system into use, provide Operations & Maintenance documentation, complete personnel training and test/evidence system functionality according to the design and specifications, and recommend adjustments as needed.

Timeline of Submittal and Contract for Services:

Qualification submittals are due at 4 p.m. on Friday, September 23, 2022. Hard copies shall be mailed or dropped off at the Creve Coeur Government Center at 300 N. New Ballas Rd., Creve Coeur, MO 63141. Please ensure timely delivery. For electronic copies, please email to salpaslan@crevecoeurmo.gov or attach the files to hard copy submittals using thumb drives. Please label all submittals re: "City of Creve Coeur Ice Arena Refrigerant System Replacement Engineering Services – Consultant Qualifications Submittal".

RFQ Issued:	August 30, 2022
RFQ Submission Deadline:	September 23, 2022 at 4:00 p.m.
Shortlist Notification:	October 7, 2022
Consultant Interviews:	October 12, 2022
Scoping Meeting:	October 17, 2022
City Council Meeting (Award of Contract):	October 24, 2022
Part I: approximately 3 months	November 7, 2022 - January 31, 2023
Part II: approximately 3 months	February 1, 2023 - April 28, 2023

An anticipated project implementation schedule based on the City's being awarded the St. Louis County Municipal Parks Grant is shown in Attachment #5. The schedule references are provided as guidelines and the submitter firms are expected to develop a schedule based on their capabilities and best industry practices as for facility outages during construction.

Instructions for Preparing Proposal:

Proposals (5 ea. hard copies) can be assembled in any format including but not limited to a Letter of Interest or Cover Letter, Qualifications package and any applicable Attachments. However, the length of the submittals shall not exceed 25 pages (single-sided) and all submittals shall be provided together with an electronic copy (either emailed to salpaslan@crevecoeurmo.gov or transmitted via a thumb drive).

Selection Process and Criteria:

The statements of qualifications (SOQ) will be evaluated by the City's review committee consisting of various City personnel. The criteria that will be utilized to score the SOQs are listed below:

- Qualifications of firm (25 points).
- Qualifications for Project Manager and Project Team (25 points).
- Relevant System Experience (25 points).
- Approach (25 points).

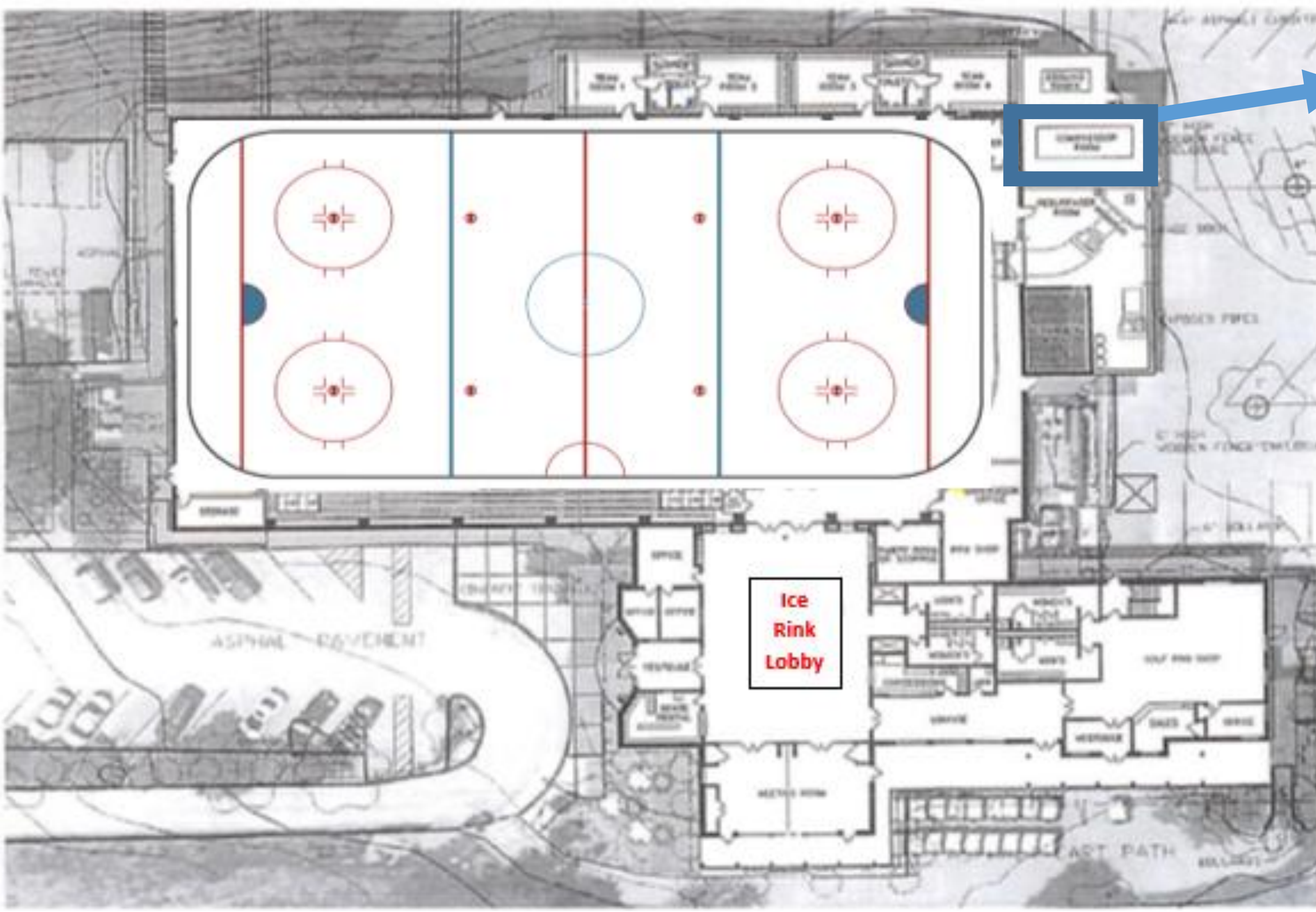
Important Considerations:
Chapter 34 of the International Building Code, 2009 Fourth Edition, is inserted as Chapter 34 of the International Building Code, 2015 Sixth Edition, as amended as set forth in Section 500.370 of the City of Creve Coeur Municipal Code. All references made to the International Existing Building Code shall be interpreted as references to Chapter 34 Existing Structures of this code.

Based on the selection of the replacement system option, International Building Code, 2015 Sixth Edition, Section 414 Hazardous Materials shall apply to the analysis and design of this project in the City of Creve Coeur.

Attachments:
1) Ice Arena Existing Layout
2) Murphy Creve Coeur Ice Arena Evaluation Report – February 15, 2021
3) Photos of the Existing System
4) Chiodini-B32 Ice Arena Refrigeration Change Feasibility Study – November 4, 2021 (Rev. April 5, 2022)
5) Anticipated Project Schedule

END OF DOCUMENT “REQUEST FOR QUALIFICATIONS – ICE ARENA REFRIGERATION SYSTEM REPLACEMENT – ENGINEERING SERVICES, CITY OF CREVE COEUR”

CREVE COEUR ICE ARENA – SITE LAYOUT



Location of compressor room that houses the R-22 ice plant system.

MURPHY

1233 North Price Road
St. Louis, MO 63132-2303
phone 314-997-6600
fax 314-997-4536
www.murphynet.com

February 15, 2021

Mr. Jason Valero
Director of Recreation
11400 Olde Cabin Road
Creve Coeur, MO 63141

RE: **Creve Coeur Ice Arena Evaluation Report**

Dear Mr. Valero,

As per your request we have evaluated your ice facility in Creve Coeur and have created the enclosed report of the Ice Rink systems.

This report is made up of four (4) parts as you have outlined in your request:

I. **Evaluation of refrigerant system for replacement refrigeration system and components**

II. **Existing equipment condition and life expectancy standards**

III. **Ice floor information**

IV. **Refrigeration plant replacement**

I. <u>**System changes for replacement refrigerants**</u>
Evaluation report with estimated budget pricing for the required changes to allow the existing system to operate with one of the new refrigerants.

a. The existing rink refrigeration system utilizes refrigerant R-22 in the mechanical cooling system that refrigerates a glycol solution pumped through a series of piping in the rink floor. This refrigerant, (R-22) due to its environmental effects to the ozone is regulated by the EPA and no longer produced as new refrigerant. Replacement refrigerant is only available of recycled refrigerant and is becoming more costly due to the availability. The system refrigerant charge is estimated at over 1,000 Lbs. Today over the counter price is near \$23.00 per lb. Total charge replacement cost if major leak occurred \$23,000 per occurrence for material only.

b. The system consists of three Carlyle model 5H120 refrigeration compressors. Carlyle recommends operating the compressors utilizing the following tested refrigerants, R-507, 404a, R-134a, or R-22.
Refrigerants R-507 and 404a are both blends which have a large glide and are not recommended to be used in a system with flooded evaporators due to the chemical breakdown. Furthermore, the refrigerant is not fully vaporized in a flooded evaporator, and the composition would consequently change for a refrigerant with glide which, occurs in refrigerant blends such as R-507 and 404a. Therefore, R-134a and R-22 are the two options for refrigerant recommended by the manufacturer in a system with a flooded evaporator such as this existing refrigeration system.

c. Exhibit (A) and exhibit (B) are two charts from the manufacture for the 5H120 Carlyle compressors showing the manufacture rated capacity in tons of refrigeration at a saturated suction temperature of zero degrees for R-134a and R-22. Notice the compressor capacity utilizing R-22 is 40.5 tons and the capacity when utilizing R-134a is 21.4 tons (at 120-degree Saturated Discharge Temperature). This shows the total actual tonnage of the three compressors of the refrigeration rink components operating with R-22 at a 0-degree saturated suction temperature is 121.5 tons of refrigeration. Two of the three compressors are designed for the total load 95% of operation the third compressor is used for redundancy or back up.
If the system were to be converted to R-134a the capacity or actual tonnage of the three 5h120 compressors would drop to 64.2 tons or 53% of the original design. To maintain the current capacity utilizing R-134a three additional compressors would need to be added to the system. In conclusion, converting the system to R-134a is not a cost-effective option. In addition to the R-134a and R-22 charts on the following page, a table has been inserted to reference when comparing capacities between the two refrigerants.

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Exibit A

Compressor	Make	Model	Nominal HP	Nominal Tons	Capacity at 0° SST R-22	Capacity at 0° SST R-134a
Compressor #1	Carlyle	5H120-A219	125	119	40.5	21.4
Compressor #2	Carlyle	5H120-A219	125	119	40.5	21.4
Compressor #3	Carlyle	5H120-A219	125	119	40.5	21.4
				Total	**121.5**	**64.2**

Exibit B

R-134a

COMPRESSOR		5F20		5F30		5F40		5F60		5H40		5H46		5H60		5H66		5H80		5H86		5H120	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
0	80	2.4	3.4	3.5	5.0	4.7	6.6	7.1	9.8	11.1	15.6	13.8	20.3	16.7	23.0	20.7	30.0	22.2	30.5	27.6	39.7	33.4	45.3
	90	2.1	3.5	3.2	5.2	4.3	6.9	6.4	10.2	10.1	16.4	12.5	21.4	15.1	24.3	18.8	31.6	20.2	32.1	25.0	41.8	30.3	47.7
	100	1.9	3.6	2.9	5.4	3.9	7.1	5.8	10.5	9.0	17.0	11.2	22.2	13.6	25.2	17.0	32.8	18.1	33.3	22.6	43.3	27.3	49.5
	105	1.8	3.7	2.7	5.4	3.7	7.2	5.5	10.6	8.5	17.3	10.6	22.4	12.9	25.5	16.0	33.2	17.1	33.7	21.3	43.8	25.8	50.2
	110	1.7	3.7	2.6	5.5	3.4	7.2	5.2	10.7	8.0	17.4	10.0	22.6	12.1	25.7	15.1	33.5	16.2	34.0	20.1	44.2	24.3	50.6
	120	1.5	3.7	2.3	5.5	3.0	7.2	4.6	10.7	7.0	17.5	8.7	22.8	10.7	25.9	13.3	33.8	14.2	34.2	17.7	44.5	21.4	51.0
	130	1.3	3.6	2.0	5.4	2.6	7.1	3.9	10.5	6.1	17.3	7.5	22.6	9.3	25.7	11.6	33.5	12.4	33.9	15.4	44.2	18.5	50.5
	140	1.1	3.5	1.7	5.2	2.2	6.9	3.4	10.2	5.1	16.8	6.4	21.9	7.9	25.1	9.9	32.7	10.6	33.1	13.2	43.1	15.8	49.3
	145	1.0	3.4	1.5	5.1	2.0	6.7	3.1	10.0	4.7	16.5	5.8	21.5	7.3	24.7	9.1	32.1	9.7	32.5	12.2	42.3	14.5	48.3

R-22

COMPRESSOR		5F20		5F30		5F40		5F60		5H40		5H40		5H60		5H66		5H80		5H86		5H120	
SST	SDT	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp	Cap.	Bhp
-40	80	1.0	2.6	1.5	4.0	2.1	5.3	3.0	7.9	5.0	12.8	6.2	16.7	7.6	18.7	9.4	24.4	10.2	24.9	12.7	32.5	15.2	36.9
-30	80	1.5	3.4	2.3	5.1	3.1	6.7	4.6	10.0	7.5	15.9	9.3	20.6	11.4	23.3	14.1	30.4	15.2	31.0	18.9	40.3	22.8	46.1
	90	1.3	3.3	2.0	5.0	2.7	6.7	4.1	10.0	6.6	15.7	8.3	20.5	10.0	23.2	12.5	30.2	13.5	30.8	16.8	40.1	20.1	45.7
-20	80	2.2	4.1	3.3	6.1	4.4	8.0	6.6	12.1	10.7	18.9	13.3	24.6	16.1	28.0	20.0	36.4	21.5	37.1	26.8	48.3	32.3	55.3
	90	1.9	4.2	3.0	6.2	4.0	8.3	6.0	12.4	9.7	19.2	12.0	24.9	14.5	28.4	18.1	36.9	19.4	37.6	24.1	49.0	29.1	56.1
	100	1.7	4.2	2.6	6.3	3.5	8.4	5.3	12.4	8.6	19.2	20.7	24.9	13.0	28.4	16.1	37.0	17.3	37.7	21.6	49.1	26.0	56.1
	105	1.6	4.2	2.5	6.2	3.3	8.4	4.9	12.4	8.1	19.1	10.0	24.8	12.2	28.3	15.2	36.9	16.3	37.6	20.3	48.9	24.4	55.9
	110	1.5	4.1	2.3	6.2	3.1	8.4	4.6	12.3	7.5	18.9	9.4	24.6	11.4	28.1	14.2	36.6	15.3	37.3	19.1	48.6	22.9	55.5
-10	80	3.0	4.7	4.6	7.1	6.1	9.3	9.2	14.1	14.7	21.9	18.1	28.5	22.0	32.4	27.3	42.2	29.3	43.0	36.5	56.0	44.0	64.2
	90	2.7	4.9	4.2	7.4	5.5	9.8	8.3	14.7	13.4	22.6	16.5	29.4	20.1	33.5	25.0	43.6	26.8	44.4	33.3	57.8	40.2	66.3
	100	2.5	5.1	3.8	7.6	5.0	10.1	7.5	15.1	12.1	23.0	15.0	29.9	18.2	34.2	22.6	44.5	24.3	45.4	30.2	59.0	36.5	67.7
	105	2.3	5.1	3.5	7.6	4.7	10.3	7.1	15.2	11.5	23.2	14.2	30.1	17.3	34.4	21.5	44.8	23.1	45.6	28.7	59.4	34.6	68.1
	110	2.2	5.1	3.3	7.7	4.5	10.4	6.7	15.3	10.9	23.2	13.5	30.2	16.4	34.5	20.3	45.0	21.9	45.8	27.2	59.6	32.8	68.3
	120	1.9	5.1	2.9	7.7	4.0	10.5	5.9	15.2	9.6	23.1	12.0	30.1	14.5	34.4	18.1	44.9	19.5	45.7	24.2	59.5	29.1	68.1
0	80	4.0	5.3	6.1	7.9	8.1	10.4	12.2	15.8	19.5	24.6	24.1	32.0	29.2	36.5	36.2	47.5	38.9	48.5	48.3	63.0	58.4	72.4
	90	3.7	5.6	5.6	8.4	7.5	11.1	11.2	16.8	18.0	25.8	22.2	33.6	26.9	38.4	33.4	49.9	35.9	50.9	44.6	66.2	53.8	76.1
	100	3.4	5.9	5.1	8.8	6.8	11.7	10.2	17.6	16.4	26.8	20.3	34.8	24.7	39.9	30.6	51.9	32.9	52.9	40.9	68.8	49.3	79.0
	105	3.2	6.0	4.9	9.0	6.5	12.0	9.7	17.9	15.7	27.2	19.4	35.3	23.5	40.4	29.2	52.6	31.4	53.6	39.0	69.6	47.1	80.1
	110	3.0	6.1	4.6	9.1	6.2	12.2	9.3	18.1	14.9	27.5	18.5	35.7	22.4	40.9	27.9	53.3	29.9	54.3	37.2	70.6	44.9	81.0
	120	2.7	6.3	4.2	9.3	5.5	12.6	8.3	18.5	13.5	27.9	16.7	36.2	20.2	41.6	25.2	54.1	27.0	55.1	33.6	71.7	40.5	82.3

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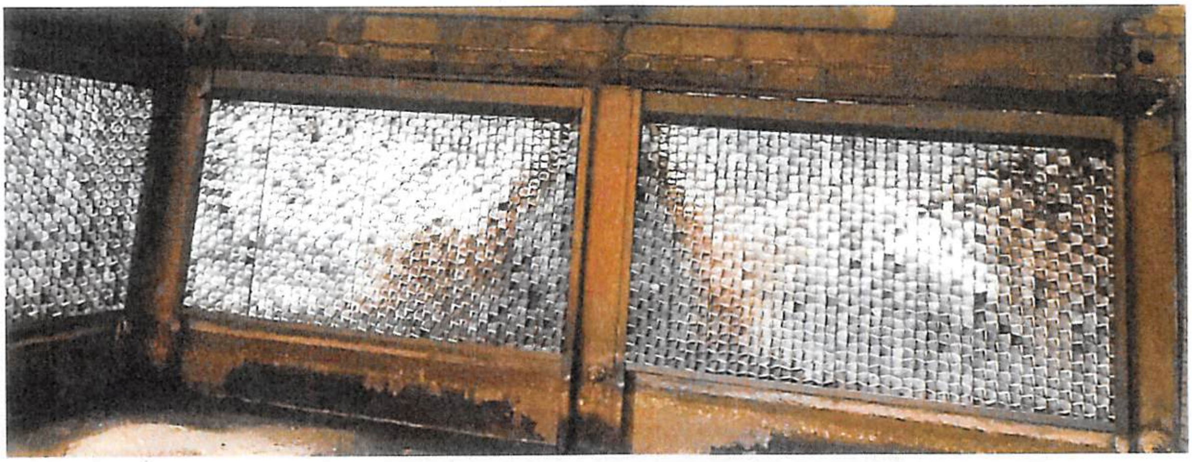
II. <u>Existing equipment condition and life expectancy</u>

Evaluation report on the condition and present budget pricing for the replacement of the individual components assuming the rink will continue the usage of R-22.

a. **<u>Compressors:</u>**
Expected equipment service life 20 years per standard ASHRAE recommendations.
Current years in is service since compressor remanufactured rebuild:
Compressor one (1) = 2 years
Compressor two (2) = 4 years
Compressor three (3) =13 years

Budget estimate to replace one compressor with remanufactured compressor = $29,500 each.

b. **<u>Evaporative Condenser:</u>**
Standard evaporative condenser equipment service life expectancy 20 years.
Current years in service = 13
Budget to replace = $126,000.00
Issues noted: Fill on tower is in poor condition and will require replacement within two years or less (see picture). teel supporting tower is compromised, very rusted. We recommend addressing rust and painting to preserve the steel supports (see picture). Condenser life has been compromised by over chemical treatment not maintained properly in the early life of condenser.



c. **Pumps**

Underfloor Circ. Pump 5HP
Expected equipment service life: 20 years.
Current years in service = 4 years
Budget to replace = $7,800 labor and material

Ice Floor Circ. Pump #1 - 15 HP
Expected equipment service life: 20 years.

Current years in service = Unable to determine, name plate not available. The manufacturer attempted referencing the identifying numbers off the bearings but, was unable to confirm age of equipment. Manufacturer Armstrong estimated that the pump was at least 20 years old as that is how far their database goes back.
Budget to replace = $11,600 labor and material

Ice Floor Circ. Pump #2 - 20 HP
Expected equipment service life: 20 years.
Current years in service = same as ice floor pump #1
Budget to replace = $12,100 labor and material

d. **Dehumidification System**
Dehumidification Unit - Indoor
Expected equipment service life: 20 years.
Current years in service = 16 years
Budget to replace = $265,000 labor and material

e. **Air Cooled Condensing Unit - Outdoor**
Expected equipment service life: 20 years.
Current years in service = 21 years
Budget to replace = $81,000 labor and material

f. **Control System**
CIMCO Control System
Expected equipment service life: 16 years.
Current years in service = 17 years
Control system is beyond the expected service life and is obsolete. CIMCO is a proprietary system and this version is obsolete in hardware

g. **Refrigerant R-22 cost today:**
R-22 is currently $23 per pound which, will continue to rise as no production or import of R-22 is allowed in 2020. Only recovered recycled refrigerant is available today. Below is the U.S. schedule for meeting the Montreal Protocol phaseout requirements, as the supply of R22 drops the price will increase significantly.

Year to Be Implemented	Implementation of HCFC Phaseout through Clean Air Act Regulations	Year to Be Implemented	Percent Reduction in HCFC Consumption and Production from Baseline
2003	No production or import of HCFC-141b	2004	35.0%
2010	No production or import of HCFC-142b and HCFC-22, except for use in equipment manufactured before January 1, 2010	2010	75.0%
2015	No production or import of any other HCFCs, except as refrigerants in equipment manufactured before January 1, 2020	2015	90.0%
2020	No production or import of HCFC-142b and HCFC-22	2020	99.5%
2030	No production or import of any HCFCs	2030	100.0%

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ASHRAE Equipment Life Expectancy chart

ASHRAE is the industry organization that sets the standards and guidelines for most all HVAC-R equipment. For additional info about ASHRAE the website is www.ashrae.org .

Equipment Item	Median Years
Air conditioners	
Window unit	10
Residential single or Split Package	15
Commercial through-the wall	15
Water-cooled package	15
Heat Pumps	
Residential air-to-air	15
Commercial air-to-air	15
Commercial water-to-air	19
Roof-top air conditioners	
Single-zone	15
Multi-zone	15
Boilers, hot water (steam)	
Steel water-tube	24 (30)
Steel fire-tube	25 (25)
Cast iron	35 (30)
Electric	15
Burners	21
Furnaces	
Gas- or oil-fired	18
Unit heaters	
Gas or electric	13
Hot water or steam	20
Radiant Heaters	
Electric	10
Hot water or steam	25

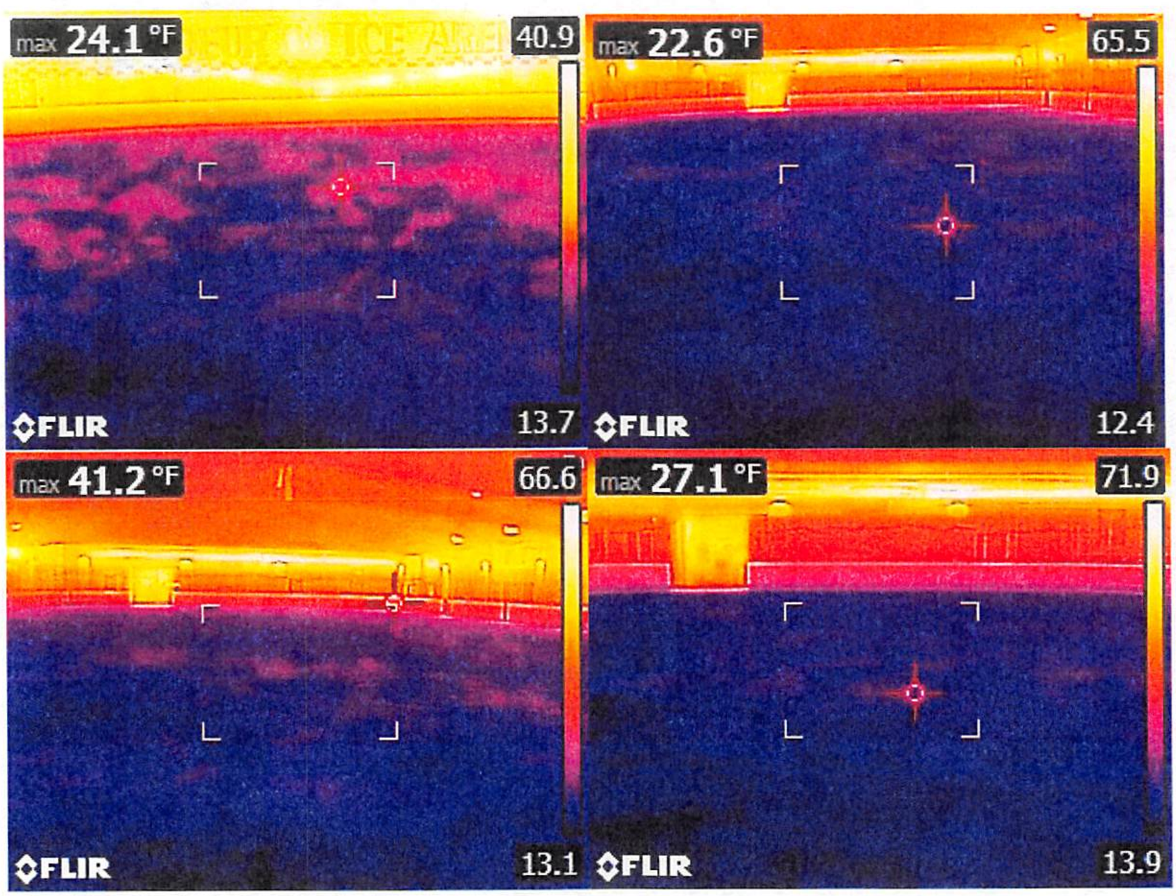
Equipment Item	Median Years
Air terminals	
Diffusers, grilles, and registers	27
Induction and fan coil units	20
VAV and double-duct boxes	20
Air washers	17
Ductwork	30
Dampers	20
Fans	
Centrifugal	25
Axial	20
Propeller	15
Ventilating roof-mounted	20
Coils	
DX, water, or steam	20
Electric	15
Heat Exchangers	
Shell-and-tube	24
Reciprocating compressors	20
Packaged chillers	
Reciprocating	20
Centrifugal	23
Absorption	23
Cooling towers	
Galvanized metal	20
Wood	20
Ceramic	34

Equipment Item	Median Years
Air-cooled condensers	20
Evaporative condensers	20
Insulation	
Molded	20
Blanket	24
Pumps	
Base-mounted	20
Pipe-mounted	10
Sump and well	10
Condensate 15	
Reciprocating engines	20
Steam turbines	30
Electric motors	18
Motor starters	17
Electric transformers	30
Controls	
Pneumatic	20
Electric	16
Electronic	15
Valve actuators	
Hydraulic	15
Pneumatic	20
Self-contained	10

III. Ice floor report

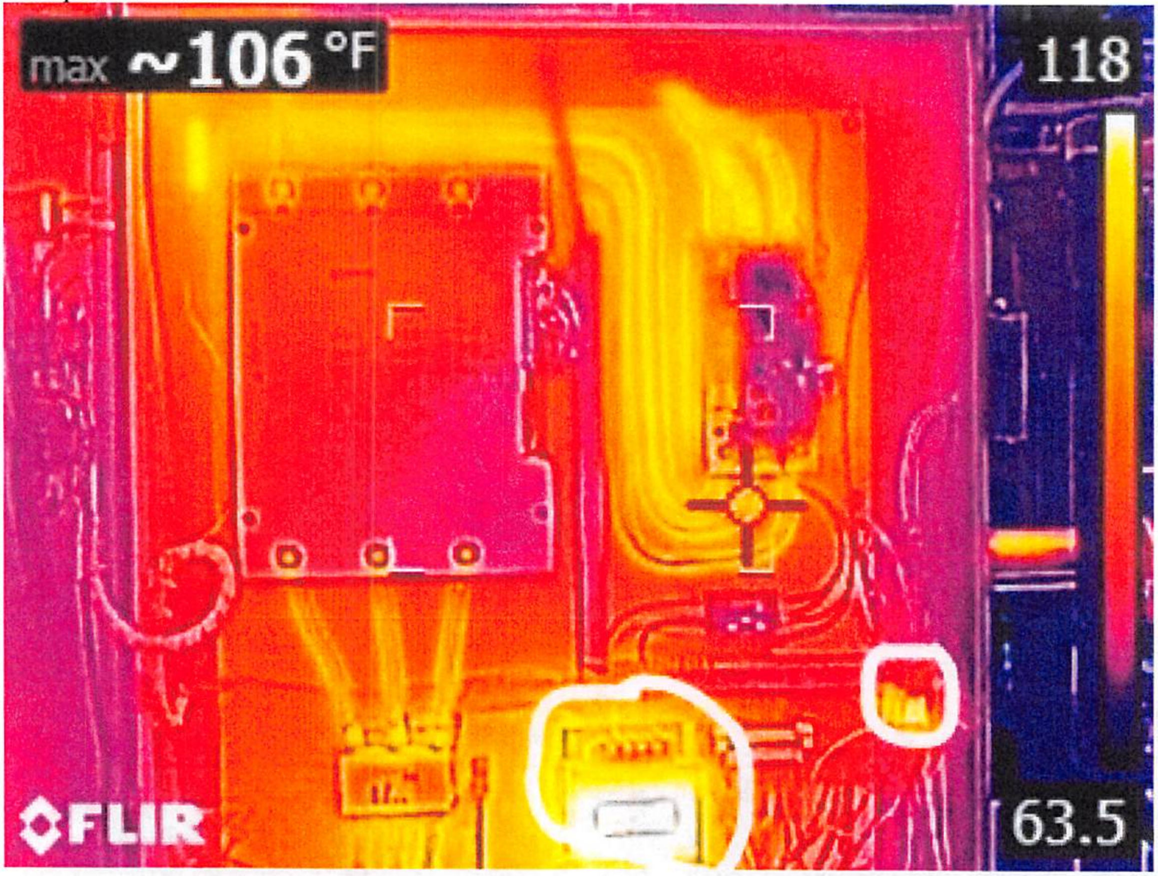
Evaluation report on the condition and present budget pricing for the status of the ice and floor heat systems to replace or repair.

a. To determine the condition of the ice loop and floor heat systems Murphy company captured thermal images of the ice, floor heat, and the starter panel. When viewing the thermal images of the ice and floor heat we were looking for large difference of temperature change which would indicate a possible leak, no large swings of temperature were identified at this time.



b. When viewing the thermal image of the compressor two panel (below) we were looking for hot spots in the panel which would indicate a loose connection or components that may fail soon. After reviewing the thermal image of the panel, we would recommend scheduling an Electrician to tighten and inspect all the connections and the transformer. Areas of concern are circled in the thermal image below in white.

Compressor Two Panel



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c. In addition to thermal imaging Murphy Company obtained fluid samples of the sub floor and cold loop glycol/water samples which, were sent to a lab for analysis. The goal of the analysis is to identify the glycol concentration and solution type.

The results of the identification of glycols analysis indicate that the cold loop and sub floor samples contain ethylene and propylene glycols in a 40/60 ratio. The identification of glycols in samples results are in the chart below. Additionally, the results of the glycol concentration analysis report can be found in a chart below as well. A summery of both reports are located at the end of this report.

Results from identification of glycols in samples.

Sample	Ethylene Glycol	Propylene Glycol
Cold Loop	40.8%	59.2%
Subfloor	40.0%	60.0%

Results from glycol concentration analysis.

RESULTS:

ANALYTE	SUB FLOOR	COLD LOOP	DATE OF ANALYSIS
Water Content	79.4	65.2	01/27/2021
Glycol Content	20.6	34.8	01/27/2021

After review of the information obtained from the two-analysis performed, under normal conditions we can determine the freeze points of the glycol solution of the sub floor and cold loop at the time that the samples of the glycol samples were taken by referencing a glycol freeze protection chart. However, since the ethylene and propylene are mixed at a 40/60 ratio confirming the freeze point to ensure that your system is properly freeze protected cannot be confirmed. Manufactures recommend propylene and ethylene glycol should not be mixed. Mixing of glycols can often result in clogged filters or gelling. We recommend that a thorough flush and clean of the system is performed and new glycol mixture put back into the system.

Budget Price flush and replace glycol: $22,500.00

d. Currently, there is no evidence that we have found to suggest that the floor needs to be replaced at this time or has any evidence of major mechanical issues. We are aware of a heaving situation of the floor near 10 years ago that after the heat loop on the floor was placed in full heat the heaving has not been noticed.

Our experience replacing rink floors and associated piping we provide the budget below to replace.

Budget to replace the floor only, including the pumps, concrete and floor pipe is $952,000. This does NOT include removal and reinstallation of the boards or painting the ice afterwards. Price excludes refrigeration, for refrigeration replacement budget see section 4.

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IV. Refrigeration plant replacement

a. To present budget pricing and scope to replace the existing refrigeration plant with ammonia and a non-ammonia system.

Replace existing refrigeration plant system with ammonia system.
Budget to replace the entire R-22 refrigeration system with an ammonia system while maintaining the existing floor budget price of, $1,491,000.00

Replace existing refrigeration plant system with non-ammonia system.
Budget to replace the entire R-22 refrigeration system, based on system utilizing R-507, a non- ammonia system, while maintaining the existing floor would be. $1,520,000.00
Excludes modifications required to accommodate dimensions of equipment in existing mechanical room. We believe this existing mechanical room would be adequate but would need to verify with system detail to confirm.

Respectfully submitted,

Bob Eichelberger

Bob Eichelberger

Cc: Mark Bengard
Cc: Frank Houston

MURPHY

St. Louis Testing Laboratories
INCORPORATED
Founded 1929

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Chemical, Metallurgical, Mechanical, Nondestructive, Environmental Testing, Analyses and Field Service

MURPHY COMPANY
1233 North Price Rd.
St. Louis, MO 63132

February 11, 2021
Lab No. 20C-0193
Invoice No. INSTL4195
Page 1 of 8

Attention: Frank Houston

REPORT OF ANALYSIS

MATERIAL: Bottles labeled Cold Loop and Subfloor

SUBJECT: Identification of glycols in Samples

TEST METHODS: ASTM D3452-06(2017) – Standard Practice for Rubber – Identification by Pyrolysis-Gas Chromatography (Py-GC/MS) - Modified

CONCLUSION:

These analyses indicate that the Cold Loop and Subfloor samples both contain ethylene and propylene glycols in a 40/60 ratio.

RESULTS:

The as-received appearances of the samples are illustrated in the enclosed Figure 1.

The samples were analyzed using Pyrolysis/Gas-Chromatography. Pyrolysis is the thermal decomposition of materials in an inert atmosphere. The sample is dropped directly into a micro-furnace with capabilities from 40°C to 1050°C. In pyrolysis, large molecules cleave at their weakest points and produce smaller, more volatile fragments. These fragments can be separated by gas chromatography. Pyrolysis chromatograms are typically complex because a wide range of different decomposition products is formed. The data can either be used as a fingerprint to prove material identity, or the GC/MS data is used to identify individual fragments to obtain structural information.

GC/MS analyses of the samples indicated that they both consist of a mixture of ethylene and propylene glycol. See enclosed Chromatograms 1 and 2 and Mass Spectra 1 through 4.

Peaks areas were measured to semi-quantitatively determine the ratio of ethylene glycol to propylene glycol. See Table 1.

Sample	Ethylene Glycol	Propylene Glycol
Cold Loop	40.8%	59.2%
Subfloor	40.0%	60.0%

Table 1 – Comparison of Glycol Ratios

Jacob W. Long, Manager
Chemical Testing

JWL/ala

MEMBER ACIL

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MURPHY COMPANY
1233 North Price Rd.
St. Louis, MO 63132

January 28, 2021
Lab No. 21E-0091
Page 1 of 1

Attention: **Scott Kelly**

REPORT OF ANALYSIS

MATERIAL: 2 Ea. Water/Glycol Solution, Submitted 01/22/2021
Sub Floor
Cold Loop

SUBJECT: Glycol Concentration

METHOD: Water Content - Karl Fischer Coulometetric Titraiton
Glycol Concentration by Difference

UNITS: Percent by Volume (% w/w)

RESULTS:

ANALYTE	SUB FLOOR	COLD LOOP	DATE OF ANALYSIS
Water Content	79.4	65.2	01/27/2021
Glycol Content	20.6	34.8	01/27/2021

SR/edn

Steve Root, Manager
Environmental Testing

Existing Conditions – Ice Arena Refrigeration System

The refrigeration system was installed in the early 2000's and is nearing the end of its life expectancy. Recent evaluation conducted by Murphy Company in February 2021, indicated the following conditions for the refrigerant system and components.

Refrigerant: The existing rink refrigeration system utilizes refrigerant R-22 in the mechanical cooling system that refrigerates a glycol solution pumped through a series of piping in the rink floor. R-2 due to environmental effects to the ozone is regulated by the EPA and no longer is produced as new refrigerant. Replacement refrigerant is only available via recycled refrigerant and is becoming more costly due to availability.

Existing Conditions – Ice Arena Refrigeration System (Continued)

Compressors: The refrigeration system consist of three (3) Carlyle model 5H120 refrigeration compressors. Expected equipment service life is 20 years per standard ASHRAE recommendations. Current years in service since compressor remanufactured rebuild:

Compressor one (1) = 3 years
Compressor two (2) = 5 years
Compressor three (3) = 14 years

Existing Conditions – Ice Arena Refrigeration System (Continued)

Evaporative Condenser: Standard evaporative condenser equipment service life expectancy is 20 years. The existing structure is 14 years old and will require replacement within two (2) years, due to rusting tower supports and compromised condenser life due to over chemical treatment in early life.

Ice Arena Refrigerant Change Feasibility Study

The Deilmann Recreation Complex

For:

City of Creve Coeur
300 N New Ballas Road
Creve Coeur, MO 63141

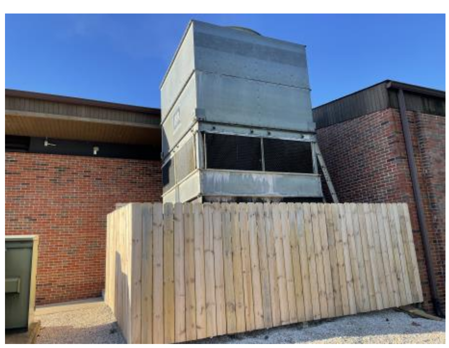
November 4, 2021
Revision 1:
April 5, 2022

Submitted by:
Scott A. Ward, P.E.
B32 Engineering Group, Inc.
2211 O'Neil Road
Hudson, WI 54016
651.256.3090

B32° Engineering Group

File No. 900.16.270

Chiodini ARCHITECTS



1.0 TABLE OF CONTENTS

2.0 BACKGROUND AND PURPOSE

The Creve Coeur Ice Arena is located in the Deilmann Recreation Complex at 11400 Olde Cabin Road in Creve Coeur, Missouri. The Creve Coeur Ice Arena has a long tradition of ice hockey, ice skating, and curling. The highest level of play at this facility is high school practices. High School games are not played at this facility due to the limited seating. As part of a continued effort: to improve operation and efficiency at the facility; to plan for future improvements to the ice system; and to continue to provide high quality ice for its user groups; the City of Creve Coeur has commissioned this study to evaluate the options for replacing the R-22 refrigerant in the existing 18-year-old indirect R-22-based ice system, or replacing the entire refrigeration system, along with other improvements. R-22 refrigerant was phased out of importation to and production in the U.S. in 2010 due to its high ozone depleting potential (ODP). In the past 6 months or so the price of R-22 refrigerant has risen substantially and is expected to keep rising as supplies have become very limited and purchases restricted to small quantities.

B32 Engineering Group, Inc. visited the site, with Chiodini Architects, on September 23, 2021. The ice sheet was in place during the site visit. B32 Engineering Group, Inc. has reviewed the Murphy report dated February 15, 2021, agree with its findings and reference it throughout this report.

The facility was built in 2003 and currently operates in the ice mode year-round.

3.0 ICE SYSTEM REVIEW

3.1 Description of Existing Ice System

The existing ice system includes a refrigeration system, a concrete ice rink floor system and a dasher board system. The existing refrigeration system is an indirect R-22-based/glycol refrigeration system and was installed in 2003. Since 2003 the following major improvements to the refrigeration system were completed:

1. 2008 – Compressor 3 remanufactured or rebuilt.
2. 2008 – New evaporative condenser.
3. 2008 - Added heat to the snow melt pit.
4. 2019 - Compressor 1 remanufactured or rebuilt.
5. 2017 – Compressor 2 remanufactured or rebuilt.
6. 2017 – Subfloor or underfloor circulation pump.
7. 2021 – Installed new fins in existing evaporative condenser. The city will finish installing interior fins in 2021.

The existing refrigeration includes: three Carlyle reciprocating compressors Model 5H120-A219 with capacity of approximately 20 tons each at a 0-degree saturated suction temperature providing a total capacity for the refrigeration system of approximately 120 tons; flooded-type plate and frame chiller system with two plate and frame chillers and one surge drum; rink floor pumps, one evaporative condenser, a control system and a waste heat recovery system. The existing system is considered a "skid package" system where the majority of the components are built and delivered on a single steel frame or "skid".

Photos 1 & 2 – Existing refrigeration system

There is a waste heat recovery system that serves the subfloor heating system under the rink floor and the snowmelt pit in the resurfacer room. This system essentially provides free heat from the refrigeration system. The subfloor heating system is reportedly in good working order and there are no concerns with frost building up under the ice rink floor. The snowmelt pit heating system is reportedly performing well.

Photo 3 – Existing evaporative condenser

Photo 4 – Existing snow melt pit and coil

The existing concrete ice rink floor was installed with the original building in 2003 and extended to NHL standard size of 200' x 85' in 2008. The fluid in the subfloor heating system is glycol. The concrete is reported to be uneven which leads to uneven ice thickness and possibly increased energy use and ice quality concerns. In 2003-04 the subfloor header piping system under score keeper's box was replaced. In 2008 the size of the rink floor was extended to the NHL standard size of 200'x85'.

Photo 5 – Overall ice rink floor

Photo 6 – Bleacher seating in ice arena

The existing refrigeration room is approximately 550 square feet which is adequate in size to house a new refrigeration system. See the conceptual ice system layout at the end of the report. There is only one access door out of this room, and it opens directly to the exterior of the building. The existing life safety systems in the refrigeration room include a gas monitoring system and mechanical ventilation and are reportedly in good - working order. B32 Engineering Group did not test or witness the operation of any life safety systems.

The existing dasher board system was installed in 2003 (18 years old) and is reaching its typical life expectancy of 20-25 years. Some improvements to the existing system were completed and include the replacement of the white poly facing and the modification of the boxes and doors to meet the requirements of the Americans with Disabilities Act (ADA) in 2008. The manufacturer of the dasher board system is not known. The system appears to be in fair condition and no other concerns have been reported.

Photo 7 – Existing dasher board system   Photo 8 – Existing dasher board system – Scorer's box

4.0 ICE SYSTEM IMPROVEMENT AND REPLACEMENT OPTIONS

4.1 General

The existing 18-year-old ice system (refrigeration system, ice rink floor and dasher board systems) is nearing its expected useful and safe life of 25 years. Some improvements have been made to the refrigeration system, as outlined above.

The scope of this study did not include evaluating the existing ice rink floor or dasher board system. Murphy performed thermal imaging on the ice rink floor in 2021 and found no large differences in temperature concluding there are likely no leaks in the piping system.

The existing refrigeration room is large enough to accommodate any of the recommended refrigeration system improvement and replacement options outlined in the next section. The conceptual ice system layout, included at the end of this report, shows the layout for Option 3 – stick built ammonia system. This drawing also shows a new access door and vestibule between the refrigeration room and the resurfacer room. The additional access will provide a more convenient access for the facility staff to enter the refrigeration room and provides another layer of protection or isolation between the refrigeration room and the resurfacer room if the ammonia option is selected. The cost estimate includes these improvements and other code required improvements to the refrigeration room each of the recommended options outlined below.

4.2 The Future of Refrigerants

When discussing ice system options, refrigerants are now the key element to consider when determining what type of refrigeration system is the best fit for your ice rink facility. So, it is necessary to understand how refrigerants impact refrigeration equipment and system options. First, let's start with a little history. R-22 has been the most popular refrigerant used in ice rink applications in recent history. With the signing of the Montreal Protocol in 1987, the United States Environmental Protection Agency (EPA) implemented the final rule of Section 604 of the Clean Air Act in July 1992, limiting the production and consumption of a set of chemicals known to deplete the stratospheric ozone layer as measured by their ozone depleting potential (ODP). R-22, which also has a high global warming potential (GWP), was one of these targeted chemicals and as of 2020, is no longer manufactured or imported in the U.S and can no longer be installed in new refrigeration systems. However, R-22 can be used in existing systems until the supply runs out.

In 2016 the Kigali Amendment was applied to the Montreal Protocol focusing on the phasedown of production and consumption of HFCs to reduce greenhouse gas emissions driving down the global warming potential (GWP) of refrigerants. More than 90 countries ratified this amendment in 2019 including Canada but excluding the U.S. as of February 2020. The U.S EPA made certain HFC refrigerants unacceptable for us in the Significant New Alternatives Policy (SNAP) Rules 20 (2016) and 21 (2017). However, the U.S. courts partially vacated these rules, and the industry is awaiting the EPA rewrite expected in 2020. Despite this, states may choose to adopt and set their own timeline for implementation of the SNAP rules . Some of the refrigerants that are currently used in ice skating facilities and are on the phasedown list include: R-134A R-404A, R- 407B, R-407C, and R-507A.

California is one of the states leading the way to lower GWP refrigerants. The California Air Resources Board (CARB) Activity adopted the SNAP Rules 20 and 21 in September 2018 and approved a limit the GWP of refrigerants used in ice rinks to < 750, following the lead of other Countries such as Canada and Europe. This would eliminate R-134a which has a global warming potential of 1410 (meaning the release of one gram of R134a would have the same global warming effect as releasing 1410 grams of carbon dioxide). In late 2020 California passed legislation reducing the GWP even lower to < 150, eliminating most synthetic refrigerants. California is part of a "Climate Alliance" that approximately 14 other states participate in, including New York, which have adopted HFC transition dates.

Currently, the ice rink industry is caught in a transition period for refrigerants as new environmental regulations are implemented. Careful consideration and evaluation of the current refrigerant options should be made. The replacement refrigerants for HCFC refrigerants (e.g., R-22, etc.) and HFC refrigerants (e.g., R-507, R407C, R-134a, etc.) are fairly new with a limited history and performance data in this application. Some of those new refrigerants are R-448A, R-449A, and R513A. R-513 is a new blended synthetic refrigerant that is supported by the National Hockey League as a sustainable, non-ozone depleting, lower global warming potential (GWP) alternative refrigerant. Its GWP is 613 and its ASHRAE Safety Classification is A1 which is lower toxicity and no flame propagation.

Large global companies, such as Coca Cola, are leading the charge to ban HFCs and use natural refrigerants such as CO2, hydrocarbons and ammonia. Since 2004, more than thirty ice skating facilities in Europe have switched over to using CO2 as the secondary refrigerant with ammonia as the primary. The first CO2-based ice system in North America, and the first *direct* CO2-based system in the world, opened in 2011 in Quebec, Canada with a second rink opening in Montreal in 2012. The U.S. now has eight ice rink facilities that use CO2. B32 Engineering Group, Inc. was the leader in this application designing the first CO2 based ice rink system in the U.S. in 2016 and has since designed five more.

4.3 Refrigeration System Improvement and Replacement Options

Four main options were identified for improving or replacing the existing refrigeration system at this facility. Additional information such as common terms or definitions, financial programs, cost estimates, etc. can be found at the end of this report. Where applicable, this report references the Murphy report dated February 15, 2021, for additional information and to provide a contractor's perspective to the improvements and cost estimates. The following options will be discussed in this section:

- Option 1: Maintain existing R-22 refrigeration system. Make selected improvements.
- Option 2: New indirect, HFC/HFO synthetic-based refrigeration system.
- Option 3: New indirect, ammonia-based refrigeration system. See conceptual layout in report.
- Option 4: New indirect, CO2-based refrigeration system.

The estimated energy efficiency stated below for each refrigeration system replacement option is given to provide a rough order of magnitude only and may not be specific to this facility. The efficiency of each system can vary greatly depending on the facility type, programming, building construction, operations, weather, length of season, etc.

Cost estimates include construction cost, design, legal, financial and administration costs, and design and construction contingencies for proposed improvements. Cost estimates are based on similar work performed in ice rink facilities from 2018-2021 and recent bid results. Costs will vary depending on the time of year the projects are bid, the economic climate and the size and scope of the project. In general, costs are rising due to the number of ice rink renovation projects, cost of materials, COVID restrictions, etc.

4.3.1 Option 1: Maintain existing R-22 refrigeration system. Make selected improvements

Description: The City may elect to continue to operate the existing indirect R-22-based refrigeration system with selected improvements with the goal of replacing the system in the very near future.

Advantages:
- Lower near-term costs.
- Avoid disruption to user groups, ice schedule and revenue from construction activities.
- Allow a little more time for the new refrigerants and technology to develop. Extending the use of the existing refrigeration systems for a while longer will allow newer ice system technology, such the use of CO2 refrigerant or new synthetic replacement refrigerants, to develop allowing manufacturing costs to decrease, and service companies to gain more experience.

Disadvantages:
- On-going maintenance and equipment costs.
- Risk disruption to schedule and loss of ice as equipment and systems become less dependable.
- Risk of catastrophic leak or failure in system and high cost of repairs and refrigerant replacement.

- Increased environmental concerns with increasing risk of refrigerant release, etc.
- Future availability and higher cost of refrigerant. In the last 6 months or so R-22 refrigerant supplies have decreased substantially increasing the cost to record levels (approximately $23/pound per Murphy and expected to rise significantly higher by the end of the year) and limiting the purchase of R-22 to 30-90 pounds per purchase. The existing system has an estimated charge of over 1,000 pounds of R-22 per Murphy's report.

Recommendation: Unfortunately, at this time there is no "drop-in" or replacement refrigerant for R-22 refrigerant in a flooded type of refrigeration system like the existing system. The traditional pure synthetic refrigerants like R-507 and R-134a will most likely start to be phased out as soon as 2024 based on their high global warming potential (GWP). In addition, these refrigerants substantially decrease the capacity of the refrigeration system by 50% or more as shown in the Murphy report dated February 15, 2021. New blended synthetic refrigerants such as R-513, R-448A, R-449A, etc. would have the same issues and potentially reduce the capacity of the system even further. In addition, these new refrigerants are blends of multiple refrigerants vs pure refrigerants like R-22, R-134a etc. which would likely cause additional operational issues in a flooded-type refrigeration system. Simply replacing the refrigerant in the system is not a recommended option at this time.

Since the trend toward higher cost and lower availability for R-22 refrigerant is not expected to change any time in the foreseeable future, and there are no proven refrigerant replacements for R-22 in a flooded refrigeration system or without substantially reducing capacity, we recommend the City start budgeting and planning for a full replacement of the refrigeration system. If the City elects to continue to operate the existing system, we recommend that only the improvements or repairs that required to maintain the system in a safe working condition and to improve the monitoring of the refrigerant charge and system for leaks, etc. be performed. We recommend the following improvements, etc.

- Budget for 500 pounds of refrigerant replacement and store if possible. If a surplus of R-22 refrigerant is not purchased and stored, one smaller leak in the system could force the facility to shut down until additional R-22 could be purchased. This will likely result in the loss of the ice sheet and cancellation of programming. ***This is the first time in 20 plus years that the ice rink industry has faced this type of limitation and potential for substantial impacts to the operation of the facility.***

Cost Estimate of items above: $18,000

- Recoat condenser steel support system as recommended in Murphy report.
- Continued monitoring and testing:
  - Monitor the condition of all systems for life and safety concerns.
  - Monitor for refrigerant leaks in the system.
  - Monitor and test all fluids in the system twice a year.
  - Monitor the condition of the ice rink floor and surrounding perimeter concrete and walls. Document all cracking, heaving, movement, etc.
  - Monitor glycol temperatures from the subfloor heating system to assure the system is operating properly.
- Continue to perform the required maintenance on the equipment and systems.

Cost Estimate of items above: Typical maintenance.

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B32 ENGINEERING GROUP, INC.

4.3.2 Option 2: New indirect, HFC/HFO-synthetic based system (R-513, etc.)

Description: Replace the existing R-22-based indirect refrigeration system with a new R-513-based refrigeration system, or similar type refrigerant, located inside the existing refrigeration room with a water fluid cooler. The equipment used in this type of system is more commercial grade quality and may include direct expansion chillers (vs flooded), blended HFC or HFO refrigerant, semi-hermetic compressors (vs open drive) and pumps. B32 can provide a conceptual drawing of this system if desired.

Photo 9 - Example of a Carrier or Trane package systems

Advantages:

- Lower capital cost.
- Potentially less space required.
- Lower refrigerant charge.
- Potential to be converted to another synthetic refrigerant type as synthetic refrigerants are phased out in the future. R-513 is a new blended synthetic refrigerant by Opteon that is supported by the National Hockey League as a sustainable, non-ozone depleting, lower global warming potential (GWP) alternative refrigerant. Its GWP is 613 and its ASHRAE Safety Classification is A1 which is lower toxicity and no flame propagation. See the Future of Refrigerants section of this report for additional information.

Disadvantages:

- Lower quality of materials and equipment compared to the existing system. For example, the compressors would likely be replaced when they fail and not re-built, refrigerant piping is copper in place of steel, etc.
- Lower life expectancy (approx. 20 years vs. 30+ years for an ammonia industrial grade system).
- Lower efficiency than industrial grade system. Estimated to be 10-15% less energy efficient than the existing R-22 indirect system.
- Uses synthetic (HFO) refrigerant. Future regulations are uncertain regarding synthetic refrigerants.
- Less waste heat available to recover and use from system.
- Equipment arrangement (e.g., skid package) makes maintenance more difficult.

Cost Estimate: $1,262,000

Cost of Preventative Maintenance. All of the refrigeration system options have similar preventative maintenance requirements and costs. The main difference in maintenance cost is the type of compressors. All options can use screw or reciprocating compressors. The existing R-22 refrigeration system uses reciprocating compressors and would have the highest maintenance costs. Option 2 typical uses screw compressors and could save approximately $7,000 per year in top end maintenance on the reciprocating compressors.

Recommendation: This is a good option if the budget cannot support a natural refrigerant and these systems are currently being used in other ice rink facilities including some NHL facilities.

4.3.3 Option 3: New indirect, ammonia-based system

Description: Replace the existing R-22-based indirect refrigeration system with a new ammonia-based refrigeration system in existing refrigeration room. See figure at the end of this report for conceptual location and equipment layout.

Photo 10 - Example of a stick-built industrial grade, flooded ammonia-based system

Advantages:

- Best available proven technology for this application.
- Proven performance and dependability.
- Maximum operational efficiency. Estimate to be 20% to 25% more efficient than existing R-22 system.
- Sustainability. Ammonia is a naturally occurring refrigerant.
- Longevity of industrial grade equipment and refrigerant (30+ years). Synthetic refrigerants may be faced with future restrictions with high global warming potentials. Ammonia is also a pure refrigerant.
- Lower cost refrigerant ($2 per pounds vs. $15 to $28 per pound for synthetics)
- Availability of equipment and parts.
- Refrigerant charge will be less than the existing R-22 system. Could also explore the option of a low charge ammonia system reducing the charge to under 500 pounds.

Disadvantages:

- Requires more space. Typically, an ammonia system will require more space for the equipment because of the industrial grade equipment that is used in these systems and the systems are typically built on-site and are not a package type system.
- Recommend installing a vestibule on the inside of the existing refrigeration, as shown on the figure at the end of the report, to house life safety equipment so that it can be monitored prior to entering the ammonia room. All types of refrigeration systems require certain life safety systems like a gas monitoring system and one eyewash-shower station inside the mechanical room and an emergency ventilation switch and refrigeration stop button on the outside of the refrigeration room. For ammonia, a second eyewash-shower system is required outside the refrigeration room. The only way to provide this second system and prevent it from freezing is to construct a vestibule or install in the resurfacer room. The vestibule itself is not required by code. However, it does offer a few additional safety advantages. It provides a safe space for anyone entering the room to stop and monitor any potential hazards (like an ammonia leak) before entering the room through the gas monitoring system or window in the door. It also provides another barrier between the ammonia system and anyone that might be outside the refrigeration room. The risk of an ammonia leak is no greater than any other type of refrigerant and all refrigerants are dangerous. The amount of the ammonia that would be less than the existing R-22 system and the overall charge is much less than the large industrial facilities, so fire and explosion are much less of a concern, if at all. Ammonia refrigerant has been used in ice rink applications since they started building the facilities and is now more common than ever.
- Potentially more training required for operators of the refrigeration system. All refrigerants are dangerous and should be approached with caution and operating staff should be trained. Even though additional training is not required by code to operate an ammonia system, it is recommended that the operating staff take training courses specifically for ammonia refrigeration including both the operation and safety of the system. It has been B32's experience that most ice arena facilities that use ammonia refrigeration use an outside service company that has experience with ammonia for repairs and even some routine maintenance and system checks.
- Potentially greater health/safety hazards in comparison to synthetic refrigerants.
- Reporting requirements. There may be additional annual reports that are required depending on the volume of ammonia that will be in the system. The US EPA has been more aggressive at requiring additional reporting for ice rinks (mainly on the east coast) that operate with more than 500 pounds of ammonia. The proposed system could require as much as 900 pounds. If a low charge ammonia system was used that quantity could be much less, maybe even less than 500 pounds. The reporting for any facility that has less than 10,000 pounds is fairly straightforward. The cost estimates are based on a typical ammonia system.
- Higher capital costs.

Cost Estimate: $1,504,000

Cost of Preventative Maintenance. All of the refrigeration system options have similar preventative maintenance requirements and costs. The main difference in maintenance cost is the type of compressors. All options can use screw or reciprocating compressors. The existing R-22 refrigeration system uses reciprocating compressors and *would have the highest maintenance costs. Option 3 has historical used reciprocating compressor but in the past 5 years more screw compressors have been used. The use of screw compressors could save approximately $7,000 per year in top end maintenance on the reciprocating compressors.*

Recommendations: This option should be strongly considered because of its increased efficiency and use of natural refrigerants as well as the ever-changing phase-out of synthetic or artificial refrigerants. However, the City should be mindful of the potentially greater health hazard over synthetic or artificial refrigerants such as R-513, etc. Although all refrigerants are hazardous. It would be prudent to start discussions of the replacement options with the fire marshal, the City's insurance carrier, and other interested parties to educate them on all aspects of ammonia refrigerant.

4.3.4 Options 4: New indirect carbon dioxide (CO2)-based system

Description: Replace the existing R-134a-based refrigeration system with a new CO2-based indirect refrigeration system located inside the refrigeration room and using an air-cooled gas cooler system. The use of CO2 refrigerant may likely be the next substantial "innovation" in the ice rink industry. This option is based on a multiple semi-hermetic compressor system of approximately 200-ton, plate and shell chiller, pumps, etc. operating at leaving glycol temperatures of 10°F and entering glycol temperatures of 13°F. It's likely that this option will fit in the existing refrigeration. B32 can provide a conceptual drawing of this system to confirm. See the Future of Refrigerants section in this report for additional information on CO2 and the use of CO2 in ice rink facilities.

Photo 11 - Example of an Indirect CO2 Chiller Package

Advantages:

- Higher efficiency. CO2 indirect is estimated to be approximately 5% less efficient than an ammonia system.
- Potentially higher heat recovery temperatures.
- Potentially less space required than an industrial grade system.
- Uses an air-cooled gas cooler system which is shorter in height than the water fluid cooler proposed in Options 2 and 3.

Disadvantages:

- Higher equipment costs due to limited availability.
- Fewer contractors familiar with technology.
- Proprietary control systems used with this technology.
- Efficiency drops off in warmer temperatures.
- Additional safety devices and systems may be required.
- There is a U.S. patent on some or all of this technology as it applies to ice rinks and therefore manufacturers may be limited.

Cost Estimate: $1,635,900

Cost of Preventative Maintenance. All of the refrigeration system options have similar preventative maintenance requirements and costs. The main difference in maintenance cost is the type of compressors. All options can use screw or reciprocating compressors. The existing R-22 refrigeration system uses reciprocating compressors and would have the highest maintenance costs. Option 4 typically uses semi-hermetic reciprocating compressors which are typically not rebuilt but rather discarded and replaced when a failure occurs.

Recommendations: It is recommended that a CO2 refrigerant-based indirect refrigeration system be considered. If the City is interested in pursuing the use of CO2 refrigerant, we encourage a site visit to at least one facility that is currently using this type of system, along with in-depth discussion with the facility's management and operation personnel and manufacturer's representatives. B32 Engineering Group has extensive experience with CO2 refrigerant applications in ice rink facilities.

It is also recommended that a more in-depth study of CO2 system options and code requirements be performed during a pre-design or preliminary design phase for this project to determine the feasibility of a CO2 ice system in this facility.

5.0 PROJECT SCHEDULE

The improvements should be planned well in advance of the desired construction time so equipment and materials can be ordered and delivered to the site. Minimizing disruption to the facility's busy schedules and user groups will be a key element to the success of this project.

A very general, typical schedule for similar ice rink type projects is as follows:

Design Phase:	June-September (3-4 months)
Bidding:	October-November (October is the ideal bidding time for this type of work)
Order Materials:	November – March
Construction:	March – October (we estimate construction on this project to take 3-4 months)

If construction is started later and the new refrigeration system is not operational by October, a temporary chiller could be used until the new refrigeration system is complete. The cost of a temporary chiller system is approximately $23,000 per month plus utilities. These costs are not included in the cost estimate.

B32 Engineering Group, Inc. has extensive experience in working closely with clients to evaluate and identify renovation and improvement solutions for existing ice systems. We understand the City will use the information in this report to determine the scope of the refrigeration system replacement project. Once the project scope and funding sources have been identified, we will work closely with the City to develop a detailed project schedule.

6.0 SUPPLEMENTAL INFORMATION

6.1 General Definitions

Included in this section are definitions for the basic terminology used throughout this report.

Ice System: A term that collectively refers to the refrigeration system, ice rink floor system, waste heat recovery system and dasher board system. This is the type of system that is currently installed in this facility.

Direct System: A *direct* refrigeration system circulates the primary refrigerant (e.g., R-22) directly through the ice rink floor. There is no secondary solution or refrigerant. These types of systems were very common in the 1970's and early 1980's. Today, indirect refrigeration systems, where glycol solutions are circulated in the rink floor, are more common due to costs and environmental concerns with large quantities of refrigerant required to operate the system.

Indirect-type System (existing system at the Hockey Center): In an *indirect* system the primary refrigerant (e.g., R-22, ammonia, etc.) stays in the refrigeration room. Heat is removed from the ice rink floor through a secondary refrigerant or glycol solution that is circulated in the floor. The heat exchange between the glycol solution and the primary refrigerant takes place in the refrigeration room.

HCFC: Hydrochlorofluorocarbon (e.g., R-22, etc.) – synthetic refrigerant with less ozone depleting than CFCs (e.g., R-12, etc.) but deplete natural resources and contribute to global warming. These are phased out by the Montreal Protocol.

HFC: Hydrofluorocarbon (e.g., R404A, R407C, R-507, etc.) – synthetic refrigerant that deplete natural resources and contribute to global warming. Many have a high global warming potential (GWP) and are now to being phased out of production.

HFO: Hydrofluro-Olefins (e.g., R513A, 1234YF, etc.) – a new class of synthetic refrigerant that have a much lower global warming potential (GWP) than HCFCs or HFCs. These new refrigerants are blends of several refrigerants and are not pure refrigerants as many of the HCFCs and HFCs are.

u-HFC: Unsaturated Hydrofluorocarbons - Low GWP HFCs that produce dangerous hydrogen fluoride when they burn and transform to trifluoro-acetic acid in the atmosphere. These are generally patented and much costlier.

Natural Refrigerants: Naturally occurring refrigerants such as ammonia (R-717), carbon dioxide (CO2) and hydrocarbons.

6.2 Financial Assistance Programs.

There are several financial programs that have traditionally been used on ice rink renovation projects. The local utility companies should be consulted to determine what programs are available and apply to this project(s). They may include:

1. Engineering Assistance Study Program. Some utilities offer this program. The purpose of this program is to provide the City with the necessary business case justification to implement energy-saving opportunities. This evaluation report can be expanded to identify energy conservation opportunities, energy modeling, etc. to meet the programs requirements. Some utilities will reimburse their users up to 75% of the cost of this study. One example where the user would benefit from this additional energy analysis is in selecting a refrigerant (ammonia, CO2, etc.) or refrigeration system to replacing the existing synthetic (R-22, etc.) refrigerant or system. It is typically required that the program be pre-approved by the utility prior to starting any work on the study.
2. Rebate Programs. Rebate programs are often available through utilities for many energy improvement measures that can be performed such as lighting replacement, motor replacement, installation of variable frequency drives, improving insulation systems, etc. Custom rebate programs are also available and may apply to the refrigeration system replacement depending on the type of system selected. The utilities should be contacted to identify possible rebates prior to starting any improvement project relating to energy savings. Some rebates require preapproval prior to purchasing and installation.

END

Opinion of Probable Project Costs - Refrigerant Change Feasibility Study
Deilmann Recreation Complex, Creve Coeur MO
Creve Coeur, MO
B32 File No. 900.21.437

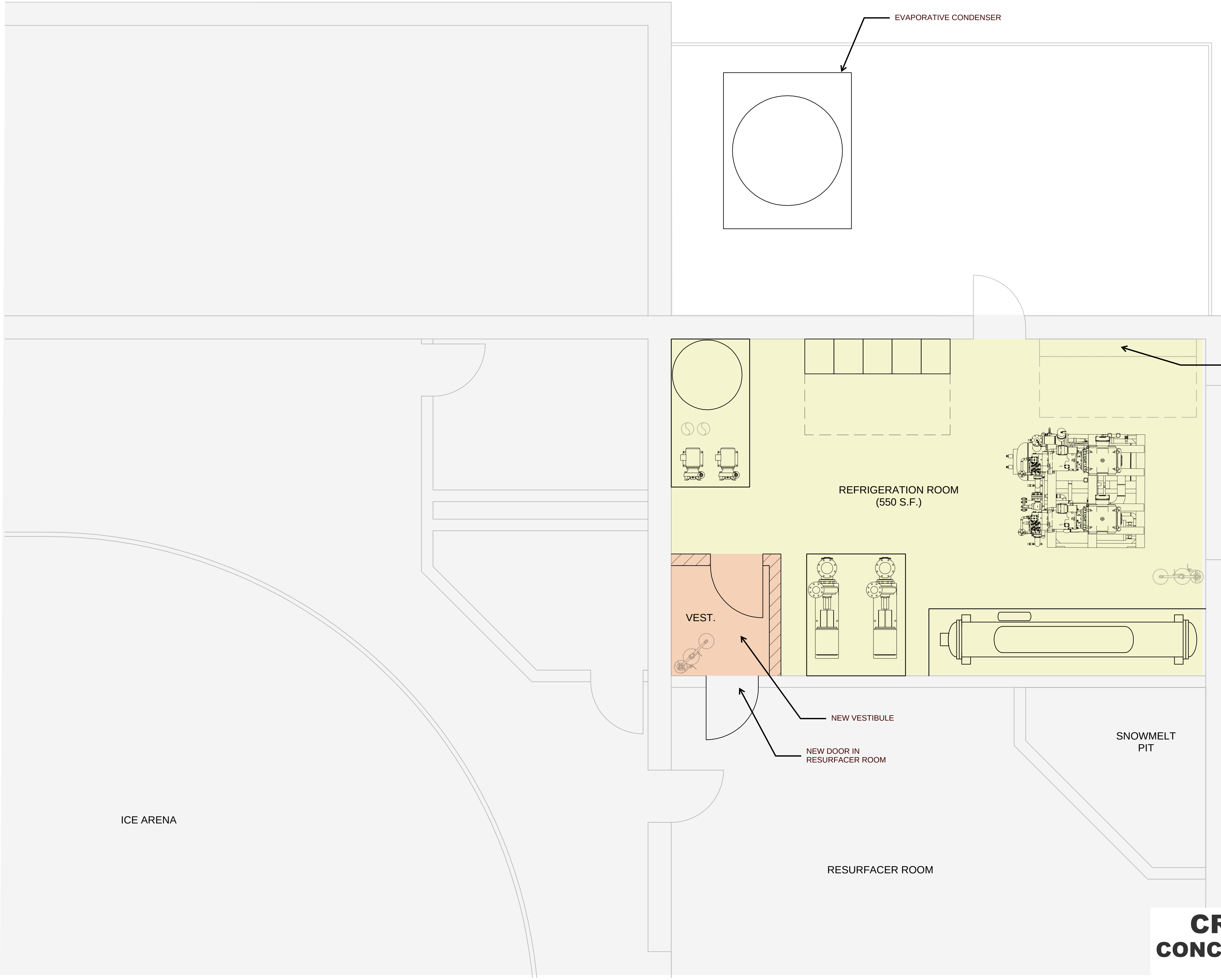
Date: 11.4.21
Revised: 7.26.22

Costs include: escalation, general conditions, ice rink contractors profit, insurance, bonds

Item	Cost Estimate[1]		
	Option 2	**Option 3**	**Option 4**
Refrigerant type	R-513	Ammonia	CO2
Grade of system	Commercial	Industrial	Mix
Demolition of existing refrigeration system and condenser	$24,000	$24,000	$24,000
Misc. HVAC demolition	$6,000	$6,000	$6,000
Misc. Electrical demolition	$6,000	$6,000	$6,000
Remove and dispose of existing glycol and flush existing rink floor, transmission mains and refrigeration system (option to test and reuse)	$21,000	$21,000	$21,000
New 120 ton refrigeration system (includes new motor control center or panels, condenser , pumps, glycol, refrigerant, etc.)	$750,000	$900,000	$1,000,000
New glycol solution	$48,000	$48,000	$48,000
Preheat for resurfacer water	Not available	Not included	Not included
Reuse existing snowmelt pit	$0	$0	$0
Concrete equipment pads	$3,000	$3,000	$3,000
Rework existing condenser supports	$6,000	$6,000	$6,000
New electric service if required	$30,000	$0	$30,000
Eyewash and shower stations (1 for synthetic and CO2 and 2 for ammonia)	$12,000	$22,000	$12,000
New ventilation system in refrigeration room	$42,000	$54,000	$42,000
Misc. plumbing in refrigeration room (water lines, move or add drains, etc.)	$18,000	$18,000	$18,000
Misc. electrical in refrigeration room (receptacles, panels, lights, etc.)	$24,000	$24,000	$24,000
Replace existing single exterior door	$10,000	$10,000	$10,000
New vestibule and door into resurfacer room (vestibule for ammonia only)	$18,000	$48,000	$18,000
Misc. sitework improvements around existing refrigeration room	$0	$0	$0
New screen wall (ammonia and R513) or modify existing for CO2 option	$0	$0	$10,000
Paint interior of existing refrigeration room	$3,800	$3,800	$3,800
Subtotal of estimated construction costs	$1,021,800	$1,193,800	$1,281,800
Estimate, design and constr. Contingency (20%)[1]	$204,360	$238,760	$256,360
Total estimated construction costs	$1,226,160	$1,432,560	$1,538,160
Engineering, legal, financial and administrative (20%)[1]	$245,232	$286,512	$307,632
Total estimated project costs (2022)	**$1,471,392**	**$1,719,072**	**$1,845,792**
Expected useful life - refrigeration system (yrs.)	15-20	30+	25
Adjusted Costs for 2023[2]	$1,589,103	$1,856,598	$1,993,455
Adjusted Costs for 2024[2]	$1,716,232	$2,005,126	$2,152,932

Footnotes:

1. See cost estimate narrative in report.
2. Applied escalation costs of **8%** per year.



B32° Engineering Group

CREVE COEUR ICE ARENA
CONCEPTUAL ICE SYSTEM LAYOUT
11/1/2021

Estimated Project Schedule

Ice Arena Refrigerant System Improvement Project
Creve Coeur, Missouri

		Estimated Schedule			2022		2023												2024							
Project Phase		Duration	Start	End	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August
1.0	**Grant Administration**																									
1.1	Notification of Grant Award	1 month	November 2022	November 2022																						
1.2	Budget Adjustment for Grant	1 month	December 2022	December 2022																						
1.3	Execution of Grant Agreement	6 weeks	January 2022	January 2022																						
1.4	Order and Install Grant Signs	1 month	March 2023	March 2023																						
2.0	**Refrigerant System Design**																									
2.1	Execute Contracts	1 month	December 2022	December 2022																						
2.2	Design and Permitting	3 month	January 2023	March 2023																						
2.3	Finalize Bid Documents	1 month	April 2023	April 2023																						
3.0	**Refrigerant System Project**																									
3.1	Bidding	1 month	April 2023	April 2023																						
3.2	Award	1 month	May 2023	May 2023																						
3.3	Equipment Build	12 month	May 2023	April 2024																						
3.4	Equipment Installation	3 month	April 2024	June 2024																						
4.0	**Project Closeout and Reimbursement**																									
4.1	Compile Final Documents from Contractors	2 month	June 2024	July 2024																						
4.2	Prepare and Submit Reimbursement Request	1 month	August 2024	August 2024																						

October 31, 2022

Mr. Jason Valvero
Director of Recreation
11400 Olde Cabin Road
Creve Coeur, MO 63141

Via email: *jvalvero@crevecoeurmo.gov*

RE: Professional Engineering Services Proposal: Ice Arena Refrigerant System Replacement
Refrigeration System Design and Construction Observation Phase Services

Dear Mr. Valvero:

We are pleased to submit this fee proposal to provide professional engineering services for the above-mentioned project. The following proposal outlines our understanding of the project by defining the scope of our services and key assumptions made in preparing this proposal and fees associated with the Scope of Work.

SCOPE OF WORK

We propose the following scope of work in accordance with the Request for Qualifications for Ice Arena Refrigerant System Replacement Engineering Services dated August 30, 2022. *All text in italics is directly from the RFQ.*

Step 1 – Update Existing Study - *Part I – Evaluation and Alternatives Feasibility Study*

During this step the B32 Team will update the existing Chiodini-B32 Feasibility Study dated November 4, 2021 and will:

1.1 **Meeting 1** - *Attend kick-off meeting with City Project Manager and other City team members.*

1.2 *Review the two prior studies completed for the project (Murphy Evaluation dated February 15, 2021, and Chiodini-B32 Feasibility Study dated November 4, 2021-revised April 5, 2022).*

1.3 *Perform* (review again) *on -the-ground condition assessment of the existing system, its components, and the facility general arrangements and operation.* This will take place at the same time as meeting 1.

1.4 *Develop* (update existing study) *detailed analysis and technical review of feasible options for the replacement system, including their estimated cost and implementation timeline.*

1.5 *Coordinate with City staff findings and results of analysis with a final recommendation option for selection.*

1.6 **Meeting 2 -** *Present selected option to Task Force, as needed.*

1.7 *Revise document per review comments from staff.*

1.8 **Meeting 3 -** *Make final presentation to City Council for approval and consideration of the selected options.*

Step 2 – Preliminary and Final Design Phase - *Part II – Design and Bidding of the Replacement System.*

During this step the B32 Team will:

2.1 Review the replacement option approved in Step *1.*

2.2 *Develop a CAD drawing of the facility, if there is not an existing CAD drawing.*

2.3 *Verify existing drawings are accurate. Site investigation will take place during Step 1.*

2.4 *Develop process, mechanical, electrical, piping, instrumentations and controls, fire protection, structural and all other plans, drawings, specifications, estimates, narratives, spreadsheets, calculations, reports, and other elements of the replacement system design as required for project bidding and construction. During this phase we will:*

2.5 **Meetings 4 and 5:** Two (2) in person meetings with you, the City, and other project stakeholders to discuss project progress. *In cooperation with City Staff, review the design at 45% and 90%, or equivalent completion levels and coordinate any needed input and approvals for progressing onto the next level.*

2.6 Provide *evidence local, State and Federal regulatory compliance for the proposed system design and work with the regulatory officials including the Chief Building Official and Fire Marshal to amend the design as needed (refer to the section titled "Important Considerations" for additional reference).* The B32 team will hold a teleconference review meeting with these departments to review preliminary drawings.

2.7 Prepare draft and final working drawings for the refrigeration system replacement including the refrigeration system and supporting mechanical, electrical, plumbing, structural and architectural work.

2.8 Prepare draft and final specifications in CSI format and bid documents including general conditions, construction contracts, bid form, bond forms, Division 0 and 1 front end documents and technical specifications.

2.9 Prepare an Opinion of Probably Construction Costs. *Generate a conceptual cost estimate at each review level.*

2.10 Grant Administration. We understand the City will be completing the grant package and will submit this package. The B32 Team will support the City and provide cost estimates, typical technical drawings, etc. as needed for this submittal.

2.11 Develop project schedule. *Propose a detailed design development schedule that will plug into the anticipated project implementation schedule (Refer to the section titled "Timeline of Submittal and Contract for Services" in RFQ). Generate a project implementation schedule at each review level. The schedule in the RFQ is as follows:*

<u>Grant Administration</u>

Notification of grand award	*November 2022 – November 2022*
Budget Adjustment for Grant	*December 2022 – December 2022*
Execution of Grant Agreement	*January 2022 – January 2022*
Order and Install Grant Signs	*March 2023 – March 2023*
Design	
Execute Contracts:	*December 2022 – December 2022*
Part I: approximately 3 months	*November 7, 2022 – January 31, 2023*
Part II: approximately 3 months	*February 1, 2023 – April 28, 2023*
Design and permitting:	*January 2023 – March 2023*
Finalize Bid Documents:	*April, 2023 – April 2023*
Construction	
Bidding	*April, 2023 – April 2023*
Award	*May 2023 – May 2023*
Equipment Build	*May 2023 – April 2024*
Equipment installation	*April 2024 – June 2024*
Project Closeout and Reimbursement	
Compile final documents from contractors	*June 2024 – July 2024*
Prepare and Submit Reimbursement Request	*August 2024 – August 2024*

Step 3 - Bidding Assistance

During this step the B32 Team will:

3.1 Provide recommendation on bidding and award schedule.

3.2 **Meeting 6.** Attend pre-bid meeting with the contractors.

3.3 Answer questions from contractors, suppliers, design team, and the City during the bid opening and record bid results. *Assist City Staff with responses to Requests for Information during bidding, evaluate bids, and develop an award recommendation for the project construction contract.*

3.4 Review the bid results and provide input on award of construction contract. We have not included attending the bid opening in this proposal.

Step 4 – Construction Services (Optional)

The ice system (refrigeration system, waste heat recovery systems, ice rink floor system and dasher board system) is the most important system in an ice arena facility. Proper installation of these systems plays a significant role in the economic and social success of the facility. Experienced ice arena specialists provide a higher level of confidence that the installation has been done right and the final product has been constructed as the design intended.

During this step the B32 Team will:

4.1 Provide limited support (review shopdrawings, responses to Requests for Information, technical support for regulatory and code inspections, review and advise on change order requests and construction claims, technical support for final inspection/closeout) per the RFQ.

4.2 Provide 1-2 site visits by B32, 1-2 site visits by Chiodini (architectural) and 1-2 site visits by G&W (MEP).

4.3 Teleconference Meetings. We will attend teleconference meetings for the preconstruction meeting, and 3-4 other meetings throughout the construction of the project. We have not included attending weekly meetings throughout construction in this proposal.

4.3. Commissioning. *Commission the replacement system into use, provide Operation & Maintenance documentation, complete personnel training and test/evidence system functionality according to the design and specifications, and recommend adjustments as needed. This effort in this step can vary greatly depending on the level of expectations. Typically, the ice rink contractor will develop the Operation and Maintenance Manuals and perform training for City staff, the fire department, etc. Based on this, we have included the base commissioning services only including verifying equipment is operating as designed. This service will take place during the final walkthrough of the project.*

4.4 Emergency Action Plan (EAP). If the City selects the ammonia option, we recommend the City prepare an Emergency Action Plan. Ammonia is regulated under the Clean Air Act and requires all facility owner and operators to ensure safe management of all chemicals. This plan will satisfy these requirements. This is not a Risk Management Plan (RMP) which is the next level up in planning and only required for larger facilities with 10,000 pounds or more of ammonia.

ASSUMPTIONS

This proposal is based on the following assumptions.

- GETTING STARTED - Prior to starting the work, B32 Engineering Group, Inc. will be provided with full information regarding your firm's and client's requirements including any special or extraordinary considerations for the Project or special services needed and will be provided with all pertinent existing data.
- INFORMATION - B32 Engineering Group, Inc. will be relying on CAD files and topographic surveys completed and prepared by others. B32 Engineering Group, Inc. assumes no liability for the accuracy of such drawings or surveys.
- EXCLUSIONS - In preparing this proposal, certain items have been excluded from the scope of services that may or may not be required. Should these services become necessary, B32 Engineering Group, Inc. can provide them as Additional Services. The following services have been excluded from this proposal:
    - Any scope related to the ice rink floor, dasher board system, dehumidification system,

arena space or other related systems

- Concept drawings of improvements to the facility
- Evaluation of site and soil conditions in or near the building
- Rebates, grants, or other funding applications
- Energy modeling and calculations
- Life cycle cost analysis
- Permit applications
- Environmental reviews, reports or permits
- Building energy simulation.
- Sampling, laboratory and on-site material testing or performance and intrusive testing
- Hazardous material testing
- Surveying
- Record plans or as-builts.
- Project advocacy beyond the normal standard of care

COST OF SERVICES

We propose the following fixed fees for the services outlined in this proposal. The most recent construction cost estimate for an ammonia based system was provided by B32 on July 7,2022 and was $1,193,800 + $238,760 contingencies = $1,432,560 for 2022 construction. Based on recent bidding activities in the last 90 days or so on similar projects, we estimate the 2024 construction cost to range from $1,600,000 to $1,900,000.

Base Project

PART I – STUDY (STEP 1) 3 LOCAL VISITS	$36,300
PART II – PRELIMINARY AND FINAL DESIGN (STEPS 2 AND 3) 3 LOCAL MEETINGS	$96,800
TOTAL FIXED FEE SERVICES	**$133,100**

Additional Service Options

PART III – CONSTRUCTION ADMINISTRATION (STEP 4)	$58,500
DEVELOP CAD DRAWINGS FOR THE PROJECT	9,500
EMERGENCY ACTION PLAN (FOR AMMONIA SYSTEM)	9,800
TOTAL FIXED FEE SERVICES	**$77,800**

Conditions of Proposed Fee:

- EXPENSES - Reimbursable expenses are **<u>in addition to</u>** the fee above. Additional services expenses will be invoiced in accordance with our standard fee schedule.
- Taxes not included in fee.
- PAYMENTS – All payments due B32 Engineering Group, Inc. shall be made within 45 days after receipt of invoice. Services will be invoiced once per month. Finance charges will be applied to all payments not received within 30-days of invoicing. B32 Engineering Group, Inc. shall have the right to suspend work on the project upon invoice past due more than sixty (90) days from presentation, unless or until B32 Engineering Group, Inc. is satisfied that payment is forthcoming.
- ADDITIONAL SERVICES – Additional Services, if authorized in advance, will be billed in accordance with our standard fee schedule.
- FEE SCHEDULE - The attached fee schedule is valid through December 31, 2022. Any services furnished after December 31, 2022, will be charged in accordance with our 2023 fee schedule. We will not increase any item on the fee schedule by more than 5% per year for work performed in 2023. The fixed fee will remain unchanged for 2023 and 2024
- QUALIFICATIONS – The proposed construction administration fee is based on the Owner hiring an experienced ice rink contractor meeting the qualifications of B32 Engineering Group, Inc. standard Section 131811 – Ice Rink General Requirements that in general states the contractor must have successfully completed five (5) ice rink projects of similar scope in the past five (5) years.
- INSURANCE. This proposal is based on the following insurance coverage carried by B32 Engineering Group, Inc.

Category	Insurance Limits
Comp General Liability and Bodily Injury	\$2M each occurrence \$4M general aggregate
Professional Liability	\$5M each claim \$5M aggregate
Umbrella Liability	\$2M each occurrence \$2M aggregate

- This proposal is based upon completion of our services by <u>August 30, 2024.</u>
- This document serves as record of the basic terms of our agreement. Upon receipt of a countersigned copy of this letter, we assume you will provide B32 Engineering Group, Inc. an agreement for review and comment.

If this proposal meets with your approval and is consistent with your understanding, please sign and return by mail an original copy of this letter. In the event we do not receive a signed copy of this letter, and we are authorized to begin work verbally, we will assume the terms and conditions of this proposal have been accepted by you.

We are very excited for this opportunity, and we look forward to personally sharing our experience and knowledge of ice systems with you and the City of Creve Coeur. If you have any questions, please feel free to contact me on my mobile at 651.492.1376.

Sincerely,

B32 ENGINEERING GROUP, INC.

Scott A. Ward, P.E.
President

Enclosure: 2022 Professional Services Fee Schedule

RFQ provided under separate cover

Agreed to and accepted,

By

Title

Date

APPENDIX A

B32° Engineering Group

2022 Professional Services Fee Schedule

Effective: January 1, 2022, through December 31, 2022

HOURLY FEE SCHEDULE

Personnel:	
Principal Engineer/Project Manager	$200-$285
Project Engineer	$150-$225
Graduate Engineer	$110-$150
Designer	$90 -$150
Technician/Inspector	$85-$135
Marketing	$75-$110
Administrative	$75-$110

REIMBURSABLE EXPENSES

Reimbursable expenses include, but are not limited to the following:

- Transportation cost at IRS allowable rate. For field vehicles, $0.24 per mile will be added to the IRS rate.
- Parking fees.
- Cost of out-of-town travel, lodging and electronic communication in connection with the project.
- Meals will be billed at $75 per diem.
- Reproductions, plots, report materials and standard form documents as outlined in the table below.

Item	Size	Black & White	Color
Photocopies/Printing	8 ½ x 11	$0.28	$1.09
	8 ½ x 14	$0.32	$1.27
	11 x 17	$0.41	$2.13
Plots/Scans over 11x17 in size	At cost of outside service		
Specification and Report Assembly (Binder, Cover)	$16.00 each		
Laminated Report Covers with Binder	$27.00 each		
3-Ring Binder	$19.00 each		

- Delivery Services (UPS, FedEx, etc.).
- Construction administrative materials.
- Subconsultant Services.
- Outside services (printing, testing, etc.).
- Other similar direct project-related expenditures.

Reimbursable expenses are billable at 12% over cost and per diem.
B32 Engineering Group, Inc.'s' typical invoicing process; monthly billing, due net 30 days.
These rates are subject to adjustment each year on January 1.

From: **Brad Holmes** <bholmes@crevecoeurmo.gov>
Date: Wed, Aug 24, 2022 at 7:41 AM
Subject: Re: Ice Rink Building
To: Jason Valvero <jvalvero@crevecoeurmo.gov>
Cc: Gregory Tate <gtate@crevecoeurmo.gov>, Sinan Alpaslan <salpaslan@crevecoeurmo.gov>

Jason / Sinan,

I can reply to Dicks concern below in red.

Here is a summary from Dick, who posed the question:

My primary concern was that we should know that the building complies with the current building code for municipal assembly use class before we spend substantial money on it. No such thing as "municipal assembly" classification in the code. It is considered as an A-2 assembly structure but the fact that it is a city owned building is not a consideration. I wanted an architect (Chiodini) to determine proper code classification and a structural engineer expert to study the original building design drawings/calcs for compliance. This is an existing building and chapter 34 is what will regulate this project. There is nothing in our code that requires the building to comply as a new structure. I think big issue will be wind related because wind load requirement has increased a lot over the last 40 years. The building is a masonry structure. I don't think it has a structural steel or concrete frame, which would be needed to withstand wind load on the walls and uplift wind forces on the roof, which reminds me of a huge frisbee. Again, wind load resistance is not an issue as it is an existing structure that met code when it was built. The introduction of an ammonia based system has no implications for wind loading. I think someone responded with name of some structural engineer who might be candidate for study. Last I heard, Jim H said he would discuss with the building official to determine whether city staff could perform the code study. Greg and I have a combined 60 years of code interpretation and application experience, no need for an outside "expert." The ice rink building is a special use class (municipal assembly) and is not a common design so staff may think a structural specialist is needed (I do). Disagree, not needed. Chiodini could do the code classification study. Architect also should determine whether building has adequate refuge space for severe storms, such as tornado. Our current code requires a storm shelter ONLY for schools and emergency operations centers (police / fire). No requirement for a storm shelter due to this project. I don't think building can be reinforced for earthquake and may not be needed. Agreed, no need to seismically brace the structure, current code would not require that type of upgrade. One other concern was the reroofing should be studied as to increasing dead load weight on the structure. I recall the lack of dehumidification system wheel exposed the structure to moisture that increases the dead load weight of the structure and reduces its capacity. This type of re-roofing analysis would ONLY be needed if you plan to install clay tiles or some other significantly heavy type of roof covering.

In my opinion the primary concern and impact to the building revolves around the equipment room where the new ammonia system will be installed. The rest of the building is not impacted by this project. No accessibility upgrades will be required. It is likely that the equipment room will need to be separated from the rest of the building by fire resistance rated walls. It is likely that the equipment room will need a robust ventilation system to change the air frequently. The impact to the building is largely dependent upon what safety systems are included with the system design. My previous email to Greg summarized some of the code sections that would apply. We would need specific details about the system being proposed so that we can properly determine what building upgrades will need to happen.

Thank You.

Brad Holmes, CBO
Senior Plans Examiner
City of Creve Coeur
Bholmes@crevecoeurmo.gov
314-442-2077 (p)
314-872-2505 (f)

CITY OF CREVE COEUR

MEMORANDUM

Date: November 1, 2022
To: Mark Perkins, City Administrator
From: Jason Valvero, Director of Recreation
CC: Jim Heines, Public Works Director
Subject: Ice Rink Engineering Services

Staff is ready to submit for consideration the attached documents that support the city to enter into an agreement with B32 Engineering Group for the final recommendation of the R-22 refrigerant replacement (part one) and the design and bid documents for that system (part two).

Background

The Creve Coeur Ice Arena uses a refrigerant system to cool the concrete slab beneath the ice sheet to allow the sheet to freeze and remain as ice. An evaluation of this system was completed on February 15, 2021. The findings included that the existing system is 19-years-old and past its prime and uses a type of refrigerant (R-22) which is no longer produced, environmentally unfriendly, difficult to find and costly to replace. All associate system components are nearing the end of their lifecycle and are not compatible with any subsequent refrigerant chosen. Based upon these findings, the City hired a consultant for conducting a refrigerant change feasibility study that was completed on November 4, 2021 (revised on April 5, 2022). The results of this study outlined refrigerant options and cost estimates for consideration.

Staff was given direction by the City Council and Facilities Task Force at the June 27, 2022 work session to continue down the path of keeping the ice rink and replacing the R-22 refrigerant system. This is the next step in that process.

Request for Qualifications (RFQ)

The Public Works and Recreation Departments solicited qualifications from engineering consulting firms to review and evaluate the Ice Arena refrigerant system and to develop a final recommendation for the feasibility of refrigerant change. The selected engineering firm or group will then design the recommended system and provide all the necessary documents to bid its construction/installation. The firm is expected to have a local design professional in the St. Louis area to support the proposed consulting work and be accessible to the city staff for meetings and field discussions. As an option, the firm may provide engineering support during construction. In their work, the consultant will also provide periodic project updates to the City's Facilities Task Force and City Council.

Proposals Submitted

Staff solicited proposals from four companies who had shown interest in the project or had the experience in projects similar to ours. The list included IMEG Corporation, ME Engineers, B32 Engineering Group and Jacobs. The city received one response from B32. IMEG and ME did not submit due to current staffing levels and project load and Jacobs never responded to the RFQ. Staff interviewed B32 on October 12, 2022. The company has extensive knowledge and experience with ice rink design and engineering throughout the United States. B32 will be partnering with Chiodini Architects as their local firm. Chiodini and B32 were the firms who conducted the Ice Arena Refrigerant Change Feasibility Study in November 2021.

Experience and References

B32 is well qualified to perform the required scope and is a major player in the ice rink industry, with collectively working on over 325 ice rink projects. B32 has performed several ice rink projects within the St. Louis area including the St Peters Rec Plex, Maryville University Hockey Center in Chesterfield, Centene Community Ice Center, Brentwood Recreation Complex, Affton Ice Rink and the Edwardsville Ice Rink in Illinois.

Reference checks were made to the following ice rinks; Affton Athletic Complex, City of Brentwood, Enterprise Center, Maryville University Hockey Center, St. Louis County and St. Peters Rec Plex.

All the references couldn't speak more highly of Scott and his team and how knowledgeable they all were. B32 maintained their schedule as related to their scope, the communication was open and the team as a whole was very responsive. Most projects had a combination of in-person, video conference and phone meetings to keep the project on task and finished on time. One rink reported they were very glad B32 was part of the team because they ran into some issues and B32 was able to address the issues right away with their expertise. B32 has played both the lead and the sub-contractor on many projects. Many of the facilities B32 was part of included a larger project and the ice rink was just a portion of the budget.

B32 was very excited about the opportunity. They were able to answer all of our questions and expand on several topics. B32 said they would have the time for a project of our size and the ability to complete the tasks within the schedule needed to keep the process moving forward.

Project Funding

The cost for B32 to complete part one of the project is $36,300 and part two is $96,800 for a grand total of $133,100. Staff feels the contract cost is reasonable when considering the overall budget and the services expected to receive. Funds will be taken form the Capital Improvement Program fund.

Recommendation

Staff is recommending to enter into a contract with B32 to conduct the next steps in the process for the following reasons:

- Team experience and expertise
- Various projects completed similar to Creve Coeur
- Input from the overwhelming positive references
- Local partnering firm that can be onsite and knows our ice rink

Staff will be happy to answer any questions the Facility Task Force may have.

REQUEST FOR QUALIFICATIONS
ENGINEERING SERVICES

CREVE COEUR ICE ARENA
ICE ARENA REFRIGERANT SYSTEM REPLACEMENT

City of Creve Coeur
Creve Coeur, MO
September 2022

Contact:

Mr. Scott Ward, P.E.
Owner
P. 651.256.3090
scott.ward@b32eng.com
www.b32eng.com

B32° Engineering Group

CITY OF CREVE COEUR, MO • 1949 •

September 21, 2022

Government Center
City of Creve Coeur
300 N New Ballas Rd
Creve Coeur, MO 63141

B32°
Engineering Group

Re: **Request for Qualifications for Professional Engineering Services:** Ice Arena Refrigerant System Replacement

Dear Purchasing Department:

B32 Engineering Group, Inc. is pleased to present our specialized experience to you and the City of Creve Coeur for professional engineering services for the proposed replacement of the refrigeration system at the Creve Coeur Ice Arena at the Dielmann Recreational Complex. We are very excited to reintroduce our firm's qualifications to you. We know you will find that our team possesses the depth and specialty experience required to ensure that the City receives the most comprehensive, detailed, and accurate information required to make informed decisions for this specialized ice rink project. As you know, we are very familiar with the facility through the completion of the Ice Arena Refrigerant Change Feasibility Study dated April, 2022.

B32 Engineering Group, Inc. has assembled an outstanding team of consultants experienced in evaluations, programming, concept design, and design and construction services for ice rink projects with collective experience of over 325 different ice rink projects. Individually and collectively the team brings to this project successful public, community-based planning and design principles and applications. We are currently working on or have recently completed local ice system designs for the Centene Community Ice Center, The Enterprise Center, Maryville University Hockey Center, St. Peters Rec Plex, Steinberg Skating Rink, Affton Ice Rink, Greensfelder Recreation Complex at Queeny Park, RP Lumber Center Edwardsville IL, and studies for the Brentwood Ice Rink, and Lindenwood Ice Arena.

I will be serving as the project manager and team leader, as well as the ice system consultant, on this project. I will also be the primary contact for the City. Our architectural design partner and local design professional will be Michael Chiodini with Chiodini Architects in St. Louis. G&W Engineering will be our MEP/HVAC partner and is also located in St. Louis. B32 Engineering Group, Inc. is a leader in the ice rink industry providing some of the most innovative, cost-effective and energy-efficient design solutions in ice arena facilities. We have extensive public, community-based ice rink experience as well as a large number of ice rink evaluation and renovation projects. We know these types of facilities very well and have thorough understanding of their needs and performance requirements.

We are confident you will find our qualifications, experience and reputation at the top of the industry. We are very enthusiastic about this exciting opportunity, and we look forward to personally sharing our experiences and knowledge of ice rinks with you and the City of Creve Coeur. If you have any questions, please feel free to call me at our office at 651.256.3090 or on my mobile at 651.492.1376.

Sincerely,
B32 ENGINEERING GROUP, INC.

Scott A. Ward, P.E.
Principal/President
Enclosure: Proposal

Contact Person with legal authorization for contracting:
Scott A. Ward, P.E. President
B32 Engineering Group, Inc.
2211 O'Neil Road
Hudson, WI 54016
O. 651.256.3090
C. 651.492.1376
Scott.ward@b32eng.com

B32°
Engineering Group

B32 Engineering Group, Inc.
2211 O'Neil Road
Hudson, WI 54016

Legal Status:
S Corporation

Owner:
Scott Ward, PE
(AK, AL, AZ, CO, CT, FL, IA, IL, MA, MD, ME, MI, MN, MO, NC, ND, NE, NH, NJ, NM, NY, NV, OH, OR, PA, RI, SD, TN, TX, VT, WA, WV, WI, WY)

Services Offered:

Ice System Design
Ice Arena Consultation
Feasibility Studies
Planning
Evaluation Studies
Energy and Operation Studies
Construction Administration
Post Construction
Funding Assistance

Our Firm

B32 Engineering Group specializes in the planning, consultation, design, and construction administration of the ice systems for ice arena facilities. As a nationally recognized leader in the ice rink industry we have completed over 325 very successful ice rink projects ranging from community-based facilities, outdoor skating surfaces, curling facilities, Division 1 College facilities to NHL facilities. A few of our recent projects include Solar4America (NHLs San Jose Sharks), War Memorial (NHLs Florida Panthers), Xcel Energy Center (NHL MN Wild), UCONN New Arena, Sacred Heart University New Arena, St. Peters Rec Plex MO, FP Lumber Center Edwardsville IL, Taft School CT, and Olympic Center Lake Placid NY.

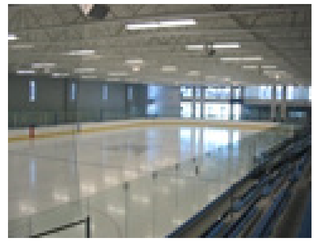
We embrace the use of renewable and sustainable materials and techniques in our standard design practices. We place them front and center during our continuous efforts to research and find new approaches, technologies, and environmentally-friendly materials and refrigerants. A few examples include: our on-going evaluation, analysis and application of CO_2 as a refrigerant and the first applications of CO_2 in the United States (B32 was the first in the United States to use CO_2 in an ice rink application); our continued new applications for using waste heat in the facility; and our very successful application using a municipal water source as a geothermal source of energy. We strongly believe that ice systems designed for longevity and minimal operation and maintenance costs will use less energy, require fewer repairs, and will play a key role in the facility's success.

Our on-going success is attributed to the passion we have for these unique facilities, ice sports in general, and the personal attention we provide for each and every project. Our involvement in the industry not only includes the professional services we provide, but the many hours we have spent as users of these facilities as hockey players, volunteer coaches, coaching coordinators, etc. and overall long term supporters of the volunteer organizations that grow and support these sports. The combination of personal and professional experiences has proven invaluable to the success of our design projects.

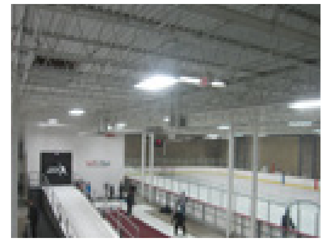
We look forward to sharing our knowledge and experiences with you.

Division I College Facilities

NHL Training Facilities



Community Facilities

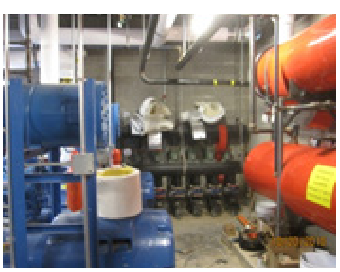


Training Centers

Multi-sheet Facilities

Outdoor Facilities

Renovation Projects



Geothermal Systems

B32 is focused on developing long-term relationships with our clients by providing a combination of innovative and traditional design solutions that provide long-term value. Client satisfaction and trust are keys to maintaining these relationships and defining a successful project.

We approach each ice rink project with honest, open communication, taking the time to listen and understand our client's needs. After gaining a solid understanding of the project, we recommend quality solutions that best fit the project and address our client's long-term goals, needs and budget. We continue with a hands-on approach as the project progresses through completion. The success of a project is not only measured by its function, value, and cost-effectiveness; but through our client's satisfaction. We strive to be a key partner in the project.

COMMITMENT TO THE INDUSTRY

We believe in sharing our knowledge for the good of the industry and being an active member in industry organizations such as the National Ice Skating Institute (ISI) and Serving the American Rinks (STAR). We look forward to sharing our experiences through annual presentations and seminars at the local level including the Minnesota and the Wisconsin Ice Arena Managers Associations conferences. Our staff actively volunteers in youth hockey associations through coaching, refereeing, clinics, fundraising, and other essential activities that support hockey at the most basic levels.

CONSULTANT RELATIONSHIPS

A comprehensive design solution for the Ice Arena Refrigerant System Replacement at the Creve Coeur Ice Arena requires a thoughtful selection of consultants. For this very important project, B32 has assembled a project team of talented and experienced architects and engineers developed through years of experience and collaboration to deliver a highly successful project to the City of Creve Coeur. Our team is rich in ice rink experience, collectively completing more than 325 ice rink projects. Below are some recent, local examples of our teams work.

B32 ENGINEERING GROUP | CHIODINI ARCHITECTS | G&W ENGINEERING GROUP:
Greensfelder Recreation Complex at Queeny Park – St. Louis County
Edwardsville New Ice + Fitness Complex- Edwardsville, Illinois
Maryville University Hockey Center - New Complex- 2-sheet Ice Facility
Clayton- Shaw Park Ice Rink (4 Season Recreational Facility) SPARC
Affton Ice Rink – Ice System Replacement, Affton MO
Icemen Igloo - Jacksonville, Florida

TEAM MEMBERS AND QUALIFICATIONS

Scott Ward, P.E.
Owner/Project Engineer

Registration

Registered Professional Engineer in AK, AL, AZ, CO, CT, FL, IA, IL, MA, MD, ME, MI, MN, MO, NC, ND, NE, NJ, NH, NM, NY, OH, PA, RI, SD, TN, TX, VT, WA, WI, WV, WY

Education

University of Minnesota
Master of Science in Mechanical Engineering

Bachelor of Civil Engineering

Professional Affiliations

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

Minnesota Ice Arena Managers Association (MIAMA)

Wisconsin Ice Arena Managers Association (WIAMA)

Ice Skating Institute (ISI)
U.S. Ice Rink Association (formerly STAR)
USA Hockey

North East Ice Skating Managers Association (NEISMA)

Minnesota Recreation & Park Association (MRPA)

Amery Youth Hockey Association - Association Coaching and Education Director 2007-2014, Coach 2001-2015

Achievements

2001 National ASHRAE Award for Design of the Super Rink's Sheet, Dual Fuel, Refrigeration System

Lectures and Presentations

"Schwan's Super Rink - Operation Evaluation Study" 2000 University of Minnesota Mechanical Engineering Department Faculty - MSME Thesis

"The Schwan's Super Rink" January 1999 Rink

"Alternative Refrigerants" Research and author 1999 in depth Study on alternative refrigerants Numerous presentations for MIAMA conferences

Mr. Ward has over 26 years experience in civil and mechanical engineering fields. His education and engineering experience uniquely qualifies him for the specialized design requirements of ice systems. With his experience in fluid hydraulics, pumping and piping systems, heat transfer, refrigeration, thermodynamics, structures and materials, Scott has developed a specialty in designing ice systems.

He has been involved in over 325 ice rink projects since 1997, including: professional venues, professional training facilities, Division 1 college venues, multi-sheet community arenas, curling facilities, outdoor ice rinks, and skating trails. Scott is integrally involved in each ice rink and curling project.

Scott brings first-hand experience to this project both as a professional designer and as a user of these facilities. As an avid life-long hockey player, fan, supporter or youth hockey, coaching coordinator, and 15 years as coach of youth hockey programs; Scott has visited and used countless ice arena facilities. This experience has proven instrumental in applying practical insight to ensure system and spaces are designed to meet the specific needs of each facility and their performance and operational goals.

REPRESENTATIVE PROJECTS

AFFTON ICE RINK
City of Concord, MO
- Ice System Design & Construction, 2020

BRENTWOOD ICE ARENA
City of Brentwood, MO
- Ice System Evaluation, 2017, 2020

CENTENE COMMUNITY ICE CENTER (4 SHEETS)
NHLs St. Louis Blues Practice Facility, St. Louis, MO
- Ice System Design and Construction, 2017-2019

CLASS OF 1965 ARENA
Colgate University, Hamilton, NY
- Ice System Design and Construction, 2014-16

COLUMBIA ICE RINK
City of Columbia, MD
- Ice System Design and Construction, 2016-17

CROWN COLISEUM COMPLEX
Cumberland County, Fayetteville, NC
- Ice System Design and Construction, 2018-19

DEERFIELD ACADEMY
City of Deerfield, MA
- Ice System Design & Construction, 2017-2018

EDWARDSVILLE ICE ARENA
City of Edwardsville, IL
- Ice System Design, 2020-2022

ENTERPRISE CENTER
NHLs St. Louis Blues Game Facility, St. Louis, MO
- Ice System Design & Construction, 2017-2018

GREENSFELDER RECREATION COMPLEX
Edger M. Queeny County Park, County of St. Louis, Ballwin, MO
- Ice System Design, 2020-2022

JMC ARENA
Erie Zoo, Erie, PA
- Ice System Design & Construction, 2018-2019

LAKE PLACID OLYMPIC CENTER
Lake Placid, NY
- Refrigeration System Replacement, 2019-2022
- Speed Skating Oval Replacement, 2019-2022

MARYVILLE UNIVERSITY HOCKEY CENTER
St. Louis, MO
- Ice System Design & Construction, 2018-2019

NORTH BUFFALO ICE RINK
Buffalo, NY
- Ice System Design & Construction, 2015-2016

PALMER ARENA
Danville, IL
- Ice System Design & Construction, 2019-2020

SHAKOPEE ICE CENTER ARENA (2 SHEETS)
City of Shakopee, MN
- Feasibility & Concept Study, 2015
- Ice System Design & Construction, 2015-2016

SHAW PARK ICE RINK
City of Clayton, MO
- Ice System Design, 2019-2022

SOLAR4AMERICA - SAN JOSE (6 SHEETS)
NHLs San Jose Sharks New Practice Facility, San Jose, CA
- Rinks 1&2 Ice System Replacement, 2017-18
- New Rinks 3,5-6 Ice System Design & Const., 2018-22

SLATER FAMILY ICE ARENA (2 SHEETS)
Bowling Green State University, OH
- Ice Rink Floor Renovation and Replacement, 2016-2017
- Ice Rink Refrigeration System and Rink Floor Replacement, 2019-20

ST. LOUIS PARK RECREATION CENTER
City of St. Louis Park, MN
- Ice System Evaluation, 2012
- Ice System Design & Construction, 2015-2016

ST. PETERS REC PLEX ARENA
City of St. Peters, MO
- Ice System Design & Construction, 2007
- North Rink Ice System Study, 2017
- North Rink Ice System Replacement, 2020-2022

SULLIVAN ARENA
University of Alaska-Anchorage and Alaska Aces, Anchorage, AK
- CO2 Ice System Design and Construction, 2014-15

THE BENTLEY ARENA
Bentley University, Waltham, MA
- Ice System Design and Construction, 2014-2016

WENTZVILLE ICE ARENA
Wentzville, MO
- Ice System Evaluation, 2018

TEAM MEMBERS AND QUALIFICATIONS

Michael brings strong leadership in Project Management. Offering more than 30 years of extensive experience, Michael directs his team's efforts from early planning through construction to exceed his clients' goals and needs. He understands the requirements for recreational facilities and particularly, ice rinks, including the desire for open and inviting spaces and the need for efficient and seamless circulation of staff, users and visitors.

Michael Chiodini, AIA
Principal/Director of Recreational Architecture

Education
University of Kansas

Bachelor of Architecture

Experience
30 Years

REPRESENTATIVE PROJECTS

JACKSONVILLE ICEMEN IGLOO ICE COMPLEX
Jacksonville, FL
- Renovated two-sheet ice facility

GREENSFELDER REC CENTER & ICE COMPLEX
Ballwin, MO
- Renovation, Queeny Park

FOREST PARK FOREVER
St. Louis, MO
- Steinberg Pavilion Feasibility Study

AFFTON ATHLETIC ASSOCIATION ICE RINK
St. Louis, MO
- New ammonia system, flooring, boards & glass

COURTZ ATHLETIC COMPLEX
St. Charles, MO

BLOOMFIELD R-XIV SCHOOL DISTRICT
Bloomfield, MO
- Gymnasium Expansion

SHAW PARK COMMUNITY ICE RINK
Clayton, MO

MARYVILLE UNIVERSITY HOCKEY COMPLEX
St. Louis, MO
- New two sheet ice rink- premier rink (seating 1200), practice rink, community rooms, restaurant and bar

CITY OF EDWARDSVILLE, IL
Edwardsville, IL
- R.P. Lumber Center Recreation Complex, Track, Fitness + Ice Complex

PALM BEACH NORTH ATHLETIC FACILITY
Palm Beach, FL

CITY OF BRENTWOOD RECREATION COMPLEX
Brentwood, MO
- Ice Rink Renovation

MISSOURI S & T ROLLA - GALE BULLMAN FITNESS COMPLEX
Rolla, MO
- Renovation + Addition

CENTENE COMMUNITY ICE CENTER - ST. LOUIS BLUES PRACTICE FACILITY
Maryland Heights, MO
- Sun Study

The B32Team is the BEST VALUE for the City of Creve Coeur.

The consultants on this team are among the most experienced and knowledgeable ice arena design specialists in the nation with well over 325 different ice rink projects completed collectively. In addition, we bring:

- Extensive ice rink experience providing a clear understanding, in very simple terms of “what works and what doesn’t work”.
- Extensive government experience. Over 95% of our ice rink project clients are municipalities and government agencies or park and recreation departments. We are very familiar with the required processes and procedures.
- Design and renovation experience for ice arenas constructed with all types of building systems
- Design experience for some of the newest community based and college ice arenas.
- Experience with codes, regulations, statutes and ordinances applicable to indoor ice arena facilities.
- Responsiveness and personal attention. The primary team members selected for this project are Owners of their respective firms. This project will be a priority for the B32 Team.

We continue to strive for improvements and have recently designed some of the most energy efficient, top performing ice systems in the industry.

Experience and passion fosters innovation.

B32 was the first in the ice rink industry to:

- Application of using waste heat to regenerate the desiccant system in place of traditional natural gas. (Northfield Ice Arena)
- Re-use of existing Holmsten Ice Rink’s direct system equipment in converting systems to indirect to minimize costs with little or no loss in operating efficiency providing the Owner with the widest range of options available. (Lund Arena - Gustavus Adolphus College)
- Design a geothermal-based ice system that uses industrial grade maximize efficiency and reduce greenhouse gas emissions. (Burnsville Ice Center)
- Design a geothermal-based ice system, without a well field, using a city water source to maximize waste heat recovery and provide superior efficiency and reliability without losing performance (Brooklyn Park Activity Center)
- We designed the first CO2-based ice system in the United States in 2014. As of today, we have designed a total of six CO2 ice systems in the United States.
- Design ice systems for LEED certified ice arena facilities including Bentley University MA (Platinum), Amsoil Arena Duluth MN (Gold), Great Park Ice & Sport Anaheim CA (Silver) and others. B32 Engineering Group, Inc. is always striving to apply sustainable practices including waste heat recovery, water reuse, using recycled water to make the ice sheet, geothermal, natural light, etc.

TEAM MEMBER REFERENCES

B32 *(In addition to the references listed in the Projects section)*

Mr. Burt Benesek
Manager - Transportation & Develop.
City of St. Peters
One St. Peters Centre Blvd
St. Peters, MO
Office: 636.477.6600
Email: *bbenesek@stpetersmo.net*

Mr. Alex Sveda
Associate Engineer
City of Casper
200 North David Street
Casper, WY 82601
Office: 307.235.8341
Email: *asveda@cityofcasperwy.com*

Mr. Mick Stibor
Ice Arena Facility Manager
Affton Ice Rink
10300 Gravois Road
St. Louis, MO 63123
Office: 314.606.7617
Email: *afftonrinkmanager@gmail.com*

Mr. Michael Ross
Chief Executive Officer
Pasadena Ice Skating Center
300 E. Green Street
Pasadena, CA 91101
Office: 626.793.2122
Email: *mross@pasadenacenter.com*

Mr. Travis Larson
Ice Operations and Event Manager
Xcel Energy Center (NHL MN Wild)
199 W Kellog Blvd
St. Paul, MN 55102
Office: 651.265.4800
Email: *tlarson@wild.com*

Mr. Craig Flor
Mariucci/Ridder Arena Facilities Director
Intercollegiate Athletics, University of MN
1901 4th St SE Room 137 MarA
Minneapolis, MN 55455
Office: 612.625.8365
Email: *florx003@umn.edu*

Chiodini Architects

Mr. Mike Croghan
President of the Affton Hockey Association
Office: 314.210.2738
Email: *mike@croghancpa.com*
Re: Affton Hockey Rinks

Mr. Tobi Moriarity
St. Louis County Parks & Recreation
Office: 314.615.0157
Email: *tmoriarty@stlouisco.com*
Re: Greensfelder Ice + Recreation Complex - Queeny Park

Mr. Tim Lowe
The Staenberg Group
Office: 314.513.0018
Email: *tlowe@tsgproperties.com*
Re: Maryville University Ice Complex/ Multiple Project

Mr. Patrick M. Quinn
Chairman, St. Louis Legacy Ice Foundation
Office: 314-619-9929
Email: *pq@legacyice.org*
Re: The Centene Ice Center

Mr. Ryan T. Zwijack, PE
City of Edwardsville, Illinois - City Engineer
Office: 618.692.7535
Email: *rzwijack@cityofedwardsville.com*
Re: R.P. Lumber Center - Ice and Sports Complex

Partial Ice Rink Project List (Since 2012)

Project No.	Facility	Project Name	Project Owner / Client	Address	Year
900-12-155	New Hope Arena	Interior Improvement Project	New Hope, City of	New Hope, MN	2012
900-12-156	St. Louis Park Recreation Center	Ice System Evaluation	St. Loius, City of	St. Louis Park, MN	2012
900-12-157	Newberry Ice Rink	Synthetic ice	Village of Newberry / Tim Wade	Newberry, MI	2012
900-12-158	Aldrich Arena	Ice System Evaluation	Ramsey County	White Bear Lake, MN	2012
900-12-159	Elk River Ice Arena	System Evaluation	Elk River, City of	Elk River, MN	2011
900-12-160	Lansing Chapman Arena	Energy and Architectural Improvement Project	Williams College, MA	Williamstown, MA	2012
900-12-161	Eden Praire Community Center	Rink 2 Floor Replacement & Ice system upgrade	Eden Prairie, City of	Eden Prairie, MN	2013
900-12-162	Ozaukee County Ice Arena	Curling Rink	Ozaukee County / Arena Systems	Cedarburg, WI	2012
900-12-163	Braemar Ice Arena	2012 CIP	City of Edina	Edina, MN	2012
900-12-164	White Bear Lake Sports Center	Ice System Replacement Evaluation	City of White Bear Lake	White Bear Lake, MN	2012
900-12-165	Calumet Colosseum	Ice Rink Refrigeration	Township of Calumet	Calumet, MI	2013
900-12-166	Rock Springs Family Recreation Center	Evaporative Condenser Replacement	City of Rock Springs	Rock Springs, WY	2012
900-12-167	Drake Arena	Evaluation Study	St. Paul Academy	St. Paul, MN	2012
900-12-168	Watertown Ice Arena	Renovation & Expansion	City of Watertown / 292 Design Group	Watertown, NY	2012
900-12-169	Moose Lake Riverside Arena	Arena Evaluation	City of Moose Lake	Moose Lake, MN	2012
900-12-170	Mitchell Ice Arena	Ice System Design	City of Mitchell / Putz Corp	Mitchell, SD	2013
900-12-171	Munn Ice Arena	Michigan State University Munn Ice Arena	Michigan State University / TowerPinkster	East Lansing, MI	2012
900-12-172	Yost Arena	Arena Study and Ice System Replacement	University of Michigan	Ann Arbor, MI	2012
900-12-173	Lawson Ice Arena	Ice System Replacement	Western Michigan University	Kalamazoo, MI	2012
900-12-174	Bowie Indoor Sports Facility	Feasibility Study	Thomas Marks Architects	Bowie, MD	2012
900-12-175	Franklin Park Ice Arena	Franklin Park Ice Arena	Franklin Park District	Chicago, IL	2013
900-12-176	Braemar Arena	West Arena Chiller Repair	City of Edina	Edina, MN	2012
900-12-177	NA	Ice System Evaluation / MOA Ice Rink Survey	RSA Engineering	Anchorage, AK	2012
900-13-178	Casper Ice Arena	Ice System Replacement	City of Casper / Commercial Refrigeration Systems	Casper, WY	2013
900-13-179	Burich Arena	Evaluation and Feasibility Study (Phases 1 & 2)	City of Hutchinson	Hutchinson, MN	2013
900-13-180	Minnesota Amateur Sports Commission	R-Funding	Stevens Engineers	Blaine, MN	2013
900-13-181	Marshall Ice Arena	Marshall Ice Arena	City of Marshall	Marshall, MN	2013
900-13-182	Wilmette Park District Centennial Ice and Tenn	Ice System Design/Ventilation System Design/Seismic Restraint Design	Wilmette Park District	Wilmette, IL	2013
900-13-183	Scheels IcePlex	Ice System Design/Dasher Board System Design/Scoring System for Bids	Ice Sports Association / Banner	Sioux Falls, SD	2013/14
900-13-184	Hibbing Curling Club	Design	City of Hibbing	Hibbing, MN	2012
900-13-185	Windom Ice Arena	Ice System Study	City of Windom	Windom, MN	2013
900-13-186	LaCrosse - Green Island Arena	Design	City of La Crosse / 292	La Crosse, WI	2013
900-13-187	St. Paul Curling Club	Curling Rink Floor Design	St. Paul Curling Club	St. Paul, MN	2013
900-13-188	Ice Den	Ice System Replacement	Coyotes Ice, LLC. / 292	Scottsdale, AZ	2011
900-13-189	Alexandria Ice Arena	Arena Expansion (3rd Sheet)	City of Alexandria / JLG Architects	Alexandria, MN	2013
900-13-190	Pine City Civic Center	Ice System Study	HTG Architects	Pine City, MN	2013
900-13-191	New Jersey Mall Rink	Ice System Design and Construction Observation Phase Servic	Mall of Americal Owners	New Jersey	2013
900-13-192	Hopkins Pavilion Study	Feasibility and Evaluation Study	City of Hopkins	Hopkins, MN	2014
900-13-193	Willmar Civic Center Arena	Mechanical System Evaluation Study	City of Willmar	Wilmar, MN	2013
900-13-194	Edina - Braemar Arena Outdoor Rink	Outdoor Rink	City of Edina / Cunnihgham	Edina, MN	2013
900-13-195	Morgan Park Sports Complex	Ice System Design and Construction Phase Svcs	Chicago Parks District / Studio GC	Chicago, IL	2013
900-13-196	UW River Falls Hunt Arena	Condenser Relocation	University of Wisconsin / KJWW	River Falls, WI	2014
900-14-197	Brett Memeorial Ice Arena	Arena Assessment	Matanuska-Susitna Borough / Wolf Architectural	Wasilla, AK	2014
900-14-198	Harry J McDonald Ice Rink	Ice System Repair	Municipality of Anchorage / Burkhart Croft Arch	Eagle River, AK	2014
900-14-199	Minot Curling Club	Floor Replacement	North Dakota State Fair Grounds	Minot, ND	2014
900-14-200	MAYSA Ice Arena	Third Sheet Addition	City of Minot/MAYSA / EAPC	Minot, ND	2014
900-14-201	Neilson Reise Arena	Arena Evaluation Study	City of Bemidji	Bemidji, MN	2014
900-14-202	Greenway Hodgins Berardo Arena	Arena Improvements	APEX	Coleraine, MN	2014
900-14-203	Omni Center	Refrigeration System Evaluation	City of Onalaska	Onalaska, WI	2014
900-14-204	Cottage Grove Ice Arena	Ice System Evaluation Study	City of Cottage Grove	Cottage Grove, MN	2008
900-14-205	South St. Paul Wakota Arena	Refrigeration System Replacement	City of South St. Paul	St. Paul, MN	2014
900-14-206	Harry J McDonald Ice Rink	Dasher Board System Design	Municipality of Anchorage / Burkhart Croft Architects	Eagle River, AK	2014
900-14-207	St. Louis Park Rec Center Outdoor Rink	Outdoor Ice System Design & Study	City of St. Louis Park / RSP	St. Louis Park, MN	2012
900-14-208	Burich Arena	Renovation Project	City of Hutchinson	Hutchinson, MN	2014
900-14-209	Ice Den - Chandler	Ice System Improvements	Coyotes Ice / 292	Chandler, AZ	2014
900-14-210	Scheels Ice Plex	Ice System Design	Ice Sports Association / Banner	Sioux Falls, SD	2013/14
900-14-211	Augsburg College	Ice System Replacement Study	Augsburg College	Minneapolis, MN	2008
900-14-212	University of Minnesota Mariucci Arena	PreDesign	University of Minnesota / JLG	Minneapolis, MN	2013
900-14-213	All Seasons Arena	Evaluation Study	City of Mandan	Mandan, ND	2014
900-14-214	Grand Forks Sports Center	Rink Floor Design	Grand Forks Park District / Arena Systems	Grand Forks, ND	2014
900-14-215	St. Paul Academy Ice Arena	Arena Predesign Study	St Paul Academy / HGA Architects and Engineers	St. Paul, MN	2014
900-14-216	Chaska Curling and Event Center	Chaska Curling and Event Center	City of Chaska / 292	Chaska, MN	2015
900-14-217	Watford City Event Center	Watford City Event Center	Watford City / JLG	Watford, ND	2014
900-14-218	Waukesha County	Ice System Evaluation Update	Waukesha County	Waukesha County, W	2010
900-14-219	Apple Valley Sports Center	Condenser Replacement	City of Apple Valley	Apple Valley, MN	2014
900-14-220	NA	EPA R-22 Rink Case Studies	ICF International	Minneapolis, MN	2014
900-14-221	Hobbs Multigenerational Facility	Facility Update	City of Hobbs / Barker Rinker Seacat Architecture	Hobbs, NM	2014
900-14-222	Hermantown Ice Arena	Arena Improvements	City of Hermantown	Hermantown, MN	2010
900-14-223	Sullivan Arena	Ice System Replacement	Municipality of Anchorage / Burkhart Croft Architects	Anchorage, AK	2013
900-14-224	Class of 1965 Arena	Ice System Design	Colgate University / Sasaki	Hamilton, NY	2014
900-14-225	Martha's Vineyard Ice Arena	Ice System Evaluation	Martha's Vineyard Ice Arena	Vineyard Haven, MA	2014
900-14-226	Ebersole Ice Arena - Delfino Park	Refrigeration System Improvements	City of White Plains	White Plains, NY	2014
900-15-227	Shakopee Community Center	Feasibility Study	Shakopee Youth Hockey Assoc. / 292	Shakopee, MN	2008
900-15-228	West St. Paul Ice Arena	Ice Arena Renovation	City of West St Paul / Wold Architects and Engineers	St. Paul, MN	2015
900-15-229	Bud King Arena	Ice System Replacement	City of Winnona	Winnona, MN	2015
900-15-230	Neilson Reise Arena	HVAC System Improvements	City of Bemidji	Bemidji, MN	2012
900-15-231	Willmar Civic Center Arena	HVAC System Improvements	City of Wilmar	Wilmar, MN	2015
900-15-232	Thief River Falls Ice Arena	Arena Evaluation	EAPC	Thief River Falls, MN	2015
900-15-233	St. Louis Park	St. Louis Park Ice System Replacement	City of St Louis Park	St. Louis Park, MN	2015
900-15-234	Deerfield Academy New Ice Arena	New Ice Arena	Deerfield Academy / Sasaki	Deerfield, MA	2015/16
900-15-235	Univ of Minnesota Ridder Arena	Condenser Replacement	University of Minnesota	Minneapolis, MN	2015
900-15-236	Reno Ice Arena	New Ice Arena	Greater Reno Community Ice Skating Association	Reno, NV	2015
900-15-237	Phillips Academy Ice Rink	Refrigeration System Replacement Peer Review	Phillips Academy / RFS	Andover, MA	2015
900-15-238	Ben Boeke Ice Arena	Ice System Replacement	Municipality of Anchorage / Burkhart Croft Architects	Anchorage, AK	2015/16
900-15-239	Bentley University Ice Arena	New Ice Arena	Bentley University / Sasaki	Waltham, MA	2015/16
900-15-240	Clearwater Florida Ice Arena	New Ice Arena	Private / Rink Tec International	Clearwater, FL	2015/16
900-15-241	Mandan Sports Complex	Ice System Design	Mandan Parks District / JLG Architects	Mandan, ND	2015/16
900-15-242	Snow King Ice Arena	Ice System Evaluation Study	City of Jackson	Jackson, WY	2015
900-15-243	Casper Ice Arena	Ice Chiller System Replacement	City of Casper	Casper, WY	2015/16
900-15-244	Duluth Entertainment and Convention Center	Curling Floor Replacement	Duluth Entertainment and Convention Center	Duluth, MN	2015/16
900-15-245	Burich Arena	Conceptual Planning of Building Improvements	City of Hutchinson	Hutchinson, MN	2016
900-15-246	Fargo Coliseum	Renovation Project	Fargo Park District / JLG Architects	Fargo, ND	2016

B32° Engineering Group

Partial Ice Rink Project List (Since 2012)

Project No.	Facility	Project Name	Project Owner / Client	Address	Year
900-19-337	Slater Family Ice Arena	Ice System Replacement (Phase 2)	Bowling Green State University / SHP Architect	Bowling Green, OH	2019
900-19-338	SHU Ice Arena	New Ice Arena	Sacred Heart University / JLG	Fairfield, CT	2019
900-19-339	Lindenwood Ice Arena	Ice Arena Study	Lindenwood University / Cochran	Wentzville MO	2019
900-19-340	Hastings Civic Arena	Ice System Study	City of Hastings	Hastings, MN	2019
900-19-341	Solar4America Ice	Rinks 3 5 and 6	San Jose Sharks / B32	San Jose, CA	2019
900-19-342	All Seasons Arena	Arena Conceptual Design	City of Mankato	Mankato, MN	2019
900-19-343	Verizon Wireless Center	Ice System Improvements	City of Mankato	Mankato, MN	2019
900-19-344	Graham Arena Complex	Mechanical and Electrical Upgrades	Olmsted County / ISG	Rochester, MN	2019
900-19-345	Anaheim Ice	Rink Floor Replacement	The Rinks / Rink Tec	Anaheim, CA	2019
900-19-346	Hazen All Seasons Arena	Ice Arena Study	Hazen Beulah Hockey Association / EAPC	Hazen, ND	2019
900-19-347	Northeast Ice Arena	Ice Arena Study - COMPLETE	Minneapolis / JLG	Minneapolis, MN	2019
900-19-348	Lund Arena	Ice System Replacement Study - COMPLETE	Gustavus Adolphus College	St. Peter, MN	2019
900-19-349	War Memorial	Ice System Design	Florida Panthers / Rossetti	Fort Lauderdale, FL	2019
900-19-350	Shaw Park All-Season Recreation Complex	Ice System Design and Construction Observation	City of Clayton / Chiodini	Clayton, MO	2019
900-19-351	Johnston Town Center	Outdoor Ice Rink	City of Johnston / Confluence	Johnston, IA	2019
900-19-352	North Athletic Facility	Ice System Design	Palm Beach Athletic Foundation / Chiodini	Palm Beach Gardens, FL	2019
900-19-354	Municipal Athletic Complex (MAC)	Pre-Design Study	City of St Cloud / JLG	St. Cloud, MN	2019
900-19-355	Jorgensen Arena	Ice Rink Study	City of Gunnison	Gunnison, CO	2019
900-19-356	East Grand Forks Ice Arena	Ice Arena Improvements	City of East Grand Forks / JLG	East Grand Forks	2019
900-19-357	Oakland Ice Center	Ice System Design and Construction Observation	City of Oakland / B32	Oakland, CA	2019
900-19-358	Schenley Park	Ice Rink Floor Replacement	City of Pittsburgh / Rink Tec	Pittsburgh, PA	2019
900-19-359	Whittemore Center Arena	Ice System Replacement	University of New Hampshire / RFS / ARC	Durham, NH	2019
900-19-360	Lake Placid ORDA	Olympic Training Center Modernization Project	NY Olympic Regional Development Authority / Cannon Design	Lake Placid, NY	2019
900-19-361	Buffalo Civic Center	Ice System Study Updated	City of Buffalo	Buffalo, MN	2019
900-19-362	Sno-King Ice Arena	Ice Rink Floor System	/ Rink Tec	Snoqualmie, WA	2019
900-19-363	Austin ISPorts	Rink Floors	/ Rink Tec	Cedar Park, TX	2019
900-19-364	3M Mariucci Arena	PreDesign Update	University of Minnesota / JLG	Minneapolis, MN	2019
900-19-365	UCONN Ice Arena	New Ice Arena	University of Connecticut / JCJ	Storrs, CT	2019
900-19-366	Wheeling Park Memorial Ice Rink	Ice Rink Floor and Dasher Replacement	Wheeling Park Commission	Wheeling, WV	2019
900-19-367	Detroit Curling Club	Curling Club Study	Detroit Curling Club	Ferndale, MI	2019
900-19-368	Wollman Rink	Ice Rink Condition Study	Central Park / McLaren Engineering Group	New York, NY	2019
900-19-369	Riverside Ice Rink	Ice System Replacement	City of Buffalo / Stieglitz Snyder Architect	Buffalo, NY	2019
900-19-370	Watts Ice Center	Ice System Study	City of Glencoe	Glencoe, IL	2019
900-19-371	Homewood Flossmoor Ice Rink Condition	Ice Rink Condition Assessment	Homewood Flossmoor Park District / Wight & Company	Flossmoor, IL	2019
900-19-372	David S Palmer Arena	Ice System Replacement	Vermillion County Metro Exposition Auditorium and Office I	Danville, IL	2019
900-19-373	Miners Event and Convention Center	Ice System Design	City of Virginia / Commercial Refrigeration	Virginia, MN	2019
900-19-374	Viking Lakes Event Center	Ice System Design	MV Eagan Ventures / Generator Studio	Eagan, MN	2019
900-19-375	Sacramento Recreation - New Ice Arena	Ice System Design	/ HTG Architects	Sacramento, CA	2019
900-20-376	Minneapolis Victory Memorial Ice Arena Study	Ice Arena Study	Mpls Public Schools, Special SD #1 / JLG	Minneapolis, MN	2020
900-20-377	Greensfelder Recreation Center of Queeny Park	Ice System Design	St Louis County Parks / Chiodini Architects	Ballwin, MO	2020
900-20-378	Edwardsville New Ice Rink and Track Complex	Ice System Design	City of Edwardsville / Chiodini Architects	Edwardsville, IL	2020
900-20-380	Farmington Ice Arena	Renovation Phase 1	City of Farmington / Wold Architects and Eng	Farmington, MN	2020
900-20-381	Yost Arena	Arena Ice Quality Study	University of Michigan / Integrated Architecture	Ann Arbor, MI	2020
900-20-382	Traverse City Curling Club	Curling system Design	Traverse City / Cornwell Architects	Traverse City, MI	2020
900-20-383	Champlin Ice Forum	Ice System Replacement	City of Champlin	Champlin, MN	2020
900-20-384	Clearwater Ice Arena	Remodel 2020	Private / Rink Tec	Clearwater, FL	2020
900-20-385	Brentwood Ice Arena	Ice System Review 2020	City of Brentwood / Chiodini	Brentwood, MO	2020
900-20-386	Cloquet Pine Valley Ice Arena	Ice System Replacement	City of Cloquet / McKinstry Essention, LLC	Cloquet, MN	2020
900-20-387	Jahn Ice Rink	Conceptual and Scopal Study	/ RFS Engineering	Pomfret, CT	2020
900-20-388	Manteca Ice and Expo Center	Conceptual and Master Plan Study	City of Manteca / Architechnica	Manteca, CA	2020
900-20-389	SAP Center	Ice Rink Floor Header System Replacement	Sharks, LLC / SAP Center	San Jose, CA	2020
900-20-390	Affton Ice Rink	Ice System Replacement	Affton Athletic Association / Kozeny Wagner	St Louis, MO	2020
900-20-391	Willette Arena	Rubber Flooring Replacement (front end docs only)	City of Stevens Point / 292	Stevens Point, WI	2020
900-20-392	ASU New Arena	Ice System Design Consultation	ASU / Mortenson	Tempe, AZ	2020
900-20-393	Dorothy Hamill Skating Rink	Ice System Design	City of Greenwich, CT / JCJ Architecture	Greenwich, CT	2020
900-20-394	Hopkins Pavilion	Cimco vs Steenburg	Drawe & Laland	Hopkins, MN	2020
900-20-395	Duffey Ice Rink	Ice System Design	Cedar Duffey 2.0 Property LLC /	Minneapolis, MN	2020
900-20-396	Rec Plex North	Ice System Design	City of St Peters / B32	St Peters, MO	2020
900-20-397	Campion Rink	Study	Hanover Improvement Society / RFS Engineering	West Lebanon, NH	2020
900-20-398	Bloomington Ice Gardens	Ice System Study	/ HGA Architects and Engineers	Bloomington, MN	
900-20-399	Hobbs Ice Arena	Refrigeration and Dehumidification Study	City of Eau Claire / City of Eau Claire	Eau Claire, WI	2020
900-20-400	The Hockey Center	Refrigeration System Study	St Paul Schools / St Paul Schools	Concord, NH	2020
900-20-401	Schottenstein Center	Ice Arena Addition Study	Ohio State University / JLG Architects	Columbus, OH	2020
900-20-402	Anoka Area Ice Arena	Ice System Replacement	Hockey Communities of Anoka Area / APEX	Anoka, MN	2020
900-20-403	Sartell Ice Rink	Ice Rinl Addition - Floor System	/ Rink Tec	Sartell, MN	2020
900-20-404	Taft School Ice Rink	Athletic Facility Update-Ice Rink Floor Conceptual Design	Taft School / Sasaki	Watertown, CT	2020
900-20-405	Braemar Ice Arena	South Rink Dehumidification System Replacement	City of Edina / NRA	Edina, MN	2020
900-20-406	IRA Civic Center	Ice System Improvements	City of Grand Rapids / IC	Grand Rapids, MN	2020
900-21-407	Birmingham Ice Rink	Ice System Replacement	City of Birmingham / Andrus Architect	Birmington, MI	2021
900-21-408	Schenley Ice Rink	Refrigeration System Replacement	City of Pittsburgh / Clark Contractors, Inc.	Pittsburgh, PA	2021
900-21-409	Outdoor Rink	Providence Outdoor Rink	City of Providence / ARUP	Providence, RI	2021
900-21-410	Sage Rink	Ice System Mechanical Upgrades	Hamilton College / RFS Engineering	Clinton, NY	2021
900-21-411	Ice and Sportsplex	Ice System Design	Private / Chiodini Architects	Jacksonville, FL	2021
900-21-412	Dassel-Cokato Rec Center	Ice Rink Floor Design	Dassel-Cokato Schook District / ISG	Dassel-Cokato, MN	2021
900-21-413	Runestone Community Center	Third Sheet Addition	Alexandria / 292 Design Group	Alexandria, MN	2021
900-21-414	New Arena	Ice System Design	Brandon Youth Hockey Association / Koch Hazard Architects	Brandon, SD	2021
900-21-415	Mayo Clinic Health System Event Center	Ice System Design Study Update	City of Mankato / City of Mankato	Mankato, MN	2021
900-21-416	Bowie Ice Arena	Ice Arena Renovation Program Study	City of Bowie / 292 Design Group	Bowie, MD	2021
900-21-417	KINO South Sports + Entertainment Center	Ice System Design	Private-City of Tuscan / JLG Architects-Alexandria	Tuscan, AZ	2021
900-21-418	Malibu Skating Center	Ice System Design	City of Redwood City / HTG Architects	Redwood City, CA	2021
900-21-419	Glacial Ridge Curling Center	Ice System Design	City of Willmar / B32	Willmar, MN	2021
900-21-420	Solar4America at Fremont	Refrigeration System Replacement	Sharks Ice / Sharks Ice	Fremont, CA	2021
900-21-422	New Arena	Kenai Ice Rink Feasibility Study	Kenai Peninula Hockey Association	Kenai, AK	2021
900-21-423	Xcel Energy Center	Refrigeration System HVAC'd Replacement Study	Xcel Energy Center	St. Paul, MN	2021
900-21-424	Jacobson Plaza - Outdoor Skating Trail	Ice System Design	City of Sioux Falls, SD / Confluence	Sioux Falls, SD	2021
900-21-425	Madison Ice Inc.	Cooling Tower Replacement	Madison Ice Inc		2021

B32° Engineering Group

Partial Ice Rink Project List (Since 2012)

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900-15-247	Minnesota Wild Practice Facility	New Practice Facility	MN Wild / Collaborative Design Group	St. Paul, MN	2016
900-15-248	Runestone Community Center	Ice System Replacement	City of Alexandria / APEX	Alexandria, MN	2016
900-16-249	Great Park Ice & Five Point Arena	New Practice Facility	Anaheim Ice / 292	Irvine, CA	2016
900-16-250	Colby Arena	New Ice Arena	Colby College / Sasaki	Waterville, ME	2016
900-16-251	Buffalo Civic Center	Ice System Study Ice System Study	City of Buffalo	Buffalo, MN	2016
900-16-252	All Seasons Arena	Ice System Status Report	Mankato Independant School District No. 77	Mankato, MN	2016
900-16-253	North Buffalo Ice Arena	Ice System Replacement	City of Buffalo / Stieglitz Snyder Architects	Buffalo, NY	2016
900-16-254	Nothern Michigan University	Ice and Mechanical Systems Study	Nothern Michigan University	Marquetet, MI	2016
900-16-255	Elk River Community Center	Feasibility Plan	City of Elk River / 292	Elk River, MN	2016
900-16-256	West Fargo New Ice Arena	Feasibility Plan	City of West Fargo / JLG	West Fargo, ND	2016
900-16-257	Litchfield Civic Center Ice Arena	Ice System Study	City of Litchfield	Litchfield, MN	2016
900-16-258	Thief River Falls Ralph Engelstadt Arena	Equipment Room Study	City of Thief River Falls	Thief River Falls, MN	2016
900-16-259	Lasker Rink and Pool [Not Constructed]	Ice Rink Renovation	Central Park Conservancy / McLaren Engineering Group	Central Park, NY	2016
900-16-260	Titletown District Outdoor Ice Rink	New Ice Rink	Green Bay Packers / Rossetti	Green Bay, WI	2016
900-16-261	Lions Park Ice Rink	New Ice Arena and Renovations	City of Shakopee / 292 Design Group	Shakopee, MN	2016
900-16-262	Chesterfield Arena (?)	Chesterfield New Ice Arena	Chiodini Associates	St Louis, MO	2016
900-16-263	Pagel Activity Center	Arena Expansion Ice System Design	City of Minnetonka / Rink Tec International	Minnetonka, MN	2016
900-16-264	Columbia Athletic Club	Ice Rink Renovation	Waldon Studio Architects	Columbia, MD	2016
900-16-265	Dempsey Anderson Ice Arena	Ice System Replacement	Municipality of Anchorage / Burkhart Croft Architects	Anchorage, OK	2016
900-16-266	Plymouth Ice Center - Rinks 1 and 2	2017 Ice System Improvements	City of Plymouth	Plymouth, MN	2016
900-16-267	Hastings Civic Arena	Ice System Improvements	Apex	Hastings, MN	2016
900-16-268	Slater Family Ice Arena	Ice Rink Floor Replacement	BGSU / SHP Leading Design	Bowling Green, OH	2016
900-16-269	VMCC Arena (BP1, PB2, PB3)	Rink Floor Replacement	City of Inver Grove Heights	Inver Grove Heights,	2016
900-16-270	All Seasons Arena	Ice System Study	Mankato Independant School District No. 77	Mankato, MN	2016
900-16-271	Watertown Municipal Arena	New Ice Arena	Cityof Watertown / RS Architects	Watertown, NY	2016
900-16-272	Polar Arena	Ice System Replacement	ISD No. 622 / LHB Corp	North St Paul, MN	2016
900-16-273	Richfield Ice Arena	Ice System Replacement	City of Richfield	Richfield, MN	2017
900-17-274	WBSC White Bear Lake Sports Center	Ice System Replacement	City of White Bear Lake / JLG Architects	White Bear Lake, MN	2017
900-17-275	Coral Ridge Ice Arena	Iowa River Landing Hockey Arena Project	JLG Architects	Coralville, IA	2017
900-17-276	Oakton Ice Arena	Ice Arena Study	Wight & Company	Park Ridge, IL	2017
900-17-277	Norwich University Arena	Evaluation Study	Norwich University / RECCO, Inc.	Northfield, VT	2017
900-17-278	Proctor Arena	New Arena	292 Design Group	Proctor, MN	2017
900-17-279	Enterprise Center (Scottrade Center)	Ice System Replacement	City of St Louis / Murphy Company	St Louis, MO	2017
900-17-280	Brett Memorial Ice Arena	Ice System Replacement	Matt Su Burrough / Burkhart Croft Architects	Wasilla, AK	2017
900-17-281	Apple Valley Sports Arena	Ice System Replacement Study	City of Apple Valley / Ameresco	Apple Valley, MN	2017
900-17-282	Sioux Falls Outdoor Rink	Outdoor Rink Study	Confluence	Sioux Falls, SD	2017
900-17-283	St Michael-Albertville Arena	New Arena	ISD No. / Architects Rego & Youngquist	Albertville, MN	2017
900-17-284	Hopkins Pavilion	2018 Building and Mechanical Improvements	City of Hopkins	Hopkins, MN	2017
900-17-285	Solar4America Ice	Rinks 1 and 2 Replacement	Sharks Ice LLC	San Jose, CA	2017
900-17-286	Litchfield Civic Center	Ice System Replacement	City of Litchfield / Bolton & Menk Inc.	Litchfield, MN	2017
900-17-287	Windom Arena	Ice System Replacement	City of Windom	Windom, MN	2017
900-17-288	Dearborn Fieldhouse & Ice Arena	Dasher Boards Replacement	UM Dearborn	Dearborn, MI	2017
900-17-289	St Louis Ice Center	Design-Build	Murphy Company	Maryland Heights,	2017
900-17-290	Augsburg Ice Arena	Ice System Replacement Project	Augsburg College	Minneapolis, MN	2017
900-17-291	Minneapolis Parks Ice Arena	Life Cycle Cost Management Plan	Minneapolis Park and Recreation Board	Minneapolis, MN	2017
900-17-292	Riverview Ice House	Riverview Ice House Study	HVS / Perkins & Will	Rockford, IL	2017
900-17-293	Elk River Ice Arena	New Ice Arena	City of Elk River / 292 Design Group	Elk River, MN	2017
900-17-294	Glacier Ice Rink	Ice Rink Study	City of Missoula / 292 Design Group	Missoula, MT	2017
900-17-295	Willmar Civic Center	Master Plan	City of Willmar / 292	Willmar, MN	2017
900-17-296	Northfield Ice Arena	New Ice Arena	Commercial Refrigeration Systems	Northfield, MN	2017
900-17-297	Willmar Civic Center	Ice System Replacement	City of Willmar	Willmar, MN	2017
900-17-298	Target Center	Ice System Third Party Review	Ice Builders	Minneapolis, MN	2017
900-17-299	Centennial Sports Arena	Evaluation Study	Centennial Youth Hockey Association	Circle Pines, MN	2017
900-17-300	Lawrenceville Athletic Center	Ice System	Architectural Resources Cambridge	Lawrenceville, NJ	2017
900-18-301	Mesabi School District Outdoor Rinks	Outdoor Ice Rinks	East Mesabi School District / Larson Engineering	Aurora, MN	2018
900-18-302	Veterans Memorial Community Center Ice Aren	West Rink Floor Replacement	Inver Grove Heights, City of	Inver Grove	2018
900-18-303	Bronco Arena	Ice System Replacement	International Falls ISD No. 361	International Falls,	2018
900-18-304	Andover Community Center	Community Center Expansion	Andover, City of/292 Design Group	Andover, MN	2018
900-18-305	Whittemore Center Arena	Whittemore Center Study	University of New Hampshire	Durham, NH	2018
900-18-306	Hobbs Ice Arena	Condenser Replacement	Eau Claire, City of	Eau Claire, WI	2018
900-18-307	Steele Hall Ice Arena	Refrig System Upgrade	NY State University / LaBella Associates	Fredonia, NY	2018
900-18-308	K.B. Willett Ice Arena	Ice System Replacement	Stevens Point	Stevens Point, WI	2018
900-18-309	South Suburban Ice Arena	New Facility	South Suburban Park & Rec District / Perkins + Will - Denver	Centennial, CO	2018
900-18-310	NorthStar Christian Academy Sports Complex	Sports Complex Design	NorthStar Group / Rink Tec	Alexandria, MN	2018
900-18-311	Northwoods CU Arena	Arena Study	City of Cloquet / SEH	Cloquet, MN	2018
900-18-312	Iorio Arena	MA Peer Review	Cushing Academy / CSL Consulting	Ashburnham, MASS	2018
900-18-313	Cottage Grove Ice Arena	Ice System Replacement	City of Cottage Grove	Cottage Grove, MN	2018
900-18-314	Rec Plex Ice System	Ice System Study	City of St Peters	St Peters, MO	2018
900-18-315	Brentwood Ice Arena	Ice Arena Evaluation	City of Brentwood / Chiodini	Brentwood, MO	2018
900-18-316	Anderson Ice Arena	Mains Replacement	Breck School / Rink Tec	Minneapolis, MN	2018
900-18-317	Remsen Arena and Hockey Rink	New Hockey Facility	Choate Rosemary Hall / MSN Architects	Wallingford, CT	2018
900-18-318	Hobbs Municipal Ice Center	Akervik Rink Upgrades	University of WI - Eau Claire / JLG	Eau Claire, WI	2018
900-18-319	Lakeville Ames Arena	Ice System Design and Construction Observation	City of Lakeville / APEX	Lakeville, MN	2018
900-18-320	Schmitz-Maki Arena	Ice Arena Improvements	City of Farmington / Wold Architects and Eng	Farmington, MN	2018
900-18-321	JMC Ice Arena	Ice Arena Renovations	Erie Zoological Society / Bostwick Design	Erie, PA	2018
900-18-322	St Cloud National Hockey and Event Center	Pre-design Study	St Cloud State University / JLG	St Cloud, MN	2018
900-18-323	Aldrich Arena	Arena Redevelopment	County of Ramsey / Loeffler	Maplewood, MN	2018
900-18-324	Fargo Sports Complex	Ice System Design and Construction Observation	Sanford Health / JLG	Fargo, ND	2018
900-18-325	Anaheim Duck Arena	New Arena Prototype	The Rinks / 292	Anaheim, CA	2018
900-18-326	Crown Coliseum Complex	Ice System Replacement	Cumberland County	Fayetteville, NC	2018
900-18-327	Redwood Empire Ice Arena	Ice System Replacement	Snoopy's Home Ice	Santa Rosa, CA	2018
900-18-328	Steinberg Pavilion	Feasibility Study	Forest Park Forever / Chiodini	St Louis, MO	2018
900-18-329	Titletown Plaza	New Skating Path - Warranty and Followup	Titletown Development, LLC / Rossetti	Green Bay, WI	2018
900-18-330	Robson Arena	Ice System Design and Construction Observation	Colorado College / JLG	Colorado Springs, CO	2018
900-18-331	UMD Sports and Health Ice Rink	Mechanical Refrigerant Replacement	University of MN	Minneapolis, MN	2018
900-18-332	Outlaw Square	Ice System Design and Construction Observation	City of Deadwood / Wyss Associates	Deadwood, SD	2018
900-18-333	Centennial Sports Center	Ice System Replacement	School District of Centennial / 292	Circle Pines, MN	2018
900-18-334	ASU The Plaza @ Mesa City Center	Ice System Design and Construction Observation	City of Mesa / Colwell Shelor Landscape Arch	Mesa, AZ	2019
900-19-335	South Billings New Arena	New Arena	City of South Billings / BRS	South Billings, MT	2019
900-19-336	Outlaw Square	Ice System Design and Construction Observation	City of Deadwood / Wyss Associates	Deadwood, SD	2019

A Few of Our Current Projects

Facility Type
Community

Expertise
Design, Construction

Owner
City of St. Peters

St. Peters Rec Plex - North
St. Peters MO

The North Ice Arena is one of two ice arena facilities owned by the City of St. Peters. The 26 year old direct R-22 ice system had exceeded it expected life and showing signs of age. The city hired B32 Engineering Group to perform a study of the ice system in 2018 and design a new ice system, refrigeration room and other facility upgrades in 2021. After flooding damaged the nearly complete construction, the new systems are ready to start up in October, 2022.

Facility Type
Professional NHL

Expertise
Design, Construction

Owner
Xcel Energy Center

Xcel Energy Center
St. Paul, MN

With an aging R-22 indirect refrigeration system, the Xcel Energy Center, home to the NHL team Minnesota Wild, hired B32 Engineering Group to design a new ammonia refrigeration system, code improvements to the new refrigeration room and a new dessicant dehumidification system for the 18,000 seat arena. The project will be publicly bid this fall and construction to take place in the summer of 2023. The total construction cost is estimated to be $6.5M.

Facility Type
Community and AHL

Expertise
Ice System Design

Owner
Private

Community First Igloo
Jacksonville FL

The existing Icemen Igloo facility included one ice sheet that was the practice facility for the AHL Icemen Hockey Team. This B32 Engineering Team with Chiodini and G&W completed the design of a complete renovation of this facility that is currently under construction and will include two ice sheets, bar & restaurant, concessions, Esports gaming area, proshop, team rooms, etc. B32 designed a new ammonia refrigeration system, two new ice sheets and dasher board systems for this facility. The challenge of this project was working with an existing building structure.

Facility Type
Community

Expertise
Ice System Design

Owner
City of Casper WY

Casper Ice Arena
Casper WY

B32 Engineering Group has been assisting the City of Casper with the replacement of the existing R-22 direct ice system since 2015 by studying alternatives for the replacement and the design and construction of a new ice rink floor, dasher board system and the relocation of an existing ammonia system from another ice arena facility in town. B32 also evaluated the existing refrigeration system to assure it could be expanded to serve a second ice sheet in the future. Overall, this was a great option for the City and which saved money and time.

St. Louis Park Rec Center - Indoor Ice Rink

St. Louis Park, Minnesota

Facility Type
Community
3 Sheets

Expertise
Evaluation, Design, Construction

Status
Completed
2016

Owner
City of
St. Louis Park, MN

Construction Cost
$4,335,000

Reference:
Cindy Walsh
Parks and Recreation Director
City of St. Louis Park
3700 Monterey Dr
St. Louis Park, MN 55416
952.924.2541
cwalsh@stlouispark.org

Jason Eisold
Rec Center Manager
Rec Center
3700 Montery Dr
St. Louis Park, MN 55416
952.924.2547
jeisold@stlouispark.org

PROJECT DESCRIPTION

As with many ice arenas built in the 1970's and 1980's, the mechanical systems for this two-rink facility had well exceeded their safe and reliable life expectancy. In addition, the City was greatly concerned with the over 8,000 pounds of R-22 that was being used in the two refrigeration systems to operate these systems.

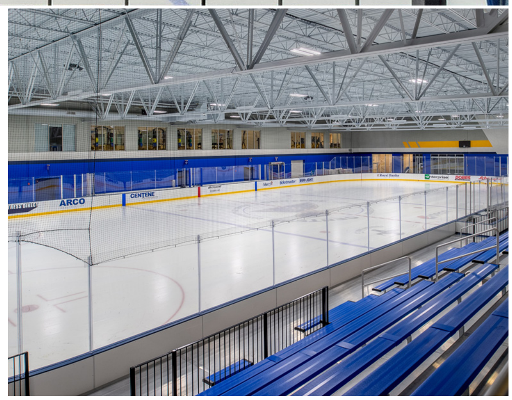
The challenges on this project were numerous. As one of the busiest ice rink facilities in the U.S., and serving many different types of user groups such as the community, a local college preparatory school, and practices for the NHL's Minnesota Wild team; significant downtime during construction was not an option. B32 Engineering Group extensive experience with ice rink renovation projects and the design of many multi-sheet facilities, assisted in planning a very successful phased construction schedule keeping one ice sheet in operation at all times.

Another significant challenge, and a key goal of the project, was replacing a highly efficient direct R-22 system with a more modern, more environmentally friendly, indirect system without increasing the utility costs. To add to this challenge was keeping the same goal of zero utility costs increase while adding a new refrigerated outdoor ice rink to this facility.

This project was a combination of: a large, multi-million-dollar ice system replacement and renovation project including two new rink floors, new dasher board system and a new common ammonia-based refrigeration system; and the construction of a new outdoor ice rink and new mechanical room. This project was successfully delivered and completed within the very restrictive summer construction season.

These improvements will efficiently and effectively serve the St. Louis Rec Center for the next three decades and beyond and solidify the facility's future as one of the elite ice arena facilities in the nation.

Centene Community Ice Center
Maryland Heights, Missouri



Facility Type
Community/Professional
4 Rinks

Expertise
Design, Construction

Status
Completed On Time
October 2019

Owner
Public-Private Partnership

Construction Cost
Privately Negotiated

Reference:
Patrick Quinn
Chairman
St. Louis Legacy Foundation
314.619.9929
pq@legacyice.org

Mark Bengard
Sr. Vice President of Sales
Murphy Company
314.795.4039
mbengard@murphynet.com

PROJECT DESCRIPTION

Centene Community Ice Center is a new 4 sheet facility that will be home to the St. Louis Blues new practice facility.

B32 was hired to design, consult, and manage construction for the duration of the project. With any multi-sheet facility, the challenges of meeting the high standards of uniform ice quality, flexibility of individual ice temperature control for each sheet of ice; while minimizing energy use and capital costs as much as possible. Meeting these goals are far greater for multi-sheet facilities compared to single sheet facilities. These challenges were amplified with this new 4-sheet facility by adding NHL level expectations throughout the facility, an outdoor ice sheet with uncontrolled ambient conditions, and providing a flexible, common refrigeration system that met the budget conscious project approach.

Our Role: Subconsultant. Ice System Design (refrigeration system, 3 indoor ice rinks and 1 outdoor ice rink, 4 dasher board systems) and consulted on site layout, building layout, etc.

Cottage Grove Ice Arena

Cottage Grove, Minnesota

Facility Type
Community

Expertise
Evaluation Study, Design, Construction

Status
Started: March 2019
Completed: October 2019

Owner
City of
Cottage Grove, Minnesota

Construction Cost
$2.7M

Reference:

Zac Dockter
Park and Recreation Director
City of Cottage Grove
8635 West Point Douglas Road
Cottage Grove, MN 55016
651.458.2847
zdockter@cottage-grove.org

Jordan Hirman
Ice Rink Manager
City of Cottage Grove
8020 80th Street South
Cottage Grove, MN 55016
651.458.3415
jhirman@cottage-grove.org

PROJECT DESCRIPTION

The Cottage Grove Ice Arena is one of the premier youth and high hockey facilities in Minnesota. B32 Engineering Group, Inc. designed the ice system for the new third ice sheet addition that took place at the Cottage Grove Ice Arena facility in 2007 and assisted the City with the planning the ice system replacement in the two original ice rinks by completing an in depth study of the ice systems at this facility.

The study included the analysis of different ice system technologies and systems and determining which system and equipment would be the best fit for this facility. Due to the site constraints, the existing refrigeration had to be reused and the change from a direct R-22 systems to an indirect ammonia system meant larger equipment. The B32 Engineering Group team determined that by making the existing refrigeration room about 2 feet wider, the new equipment would fit in the room and the room could be brought up to current code standards. This was a very cost effective solution for the facility. The renovation was completed on time and in budget and has exceeded all expectations.

Crown Coliseum

Fayetteville, NC

Facility Type
Professional & Community

Expertise
Study, Design, Construction

Status
Started: March, 2019
Completed: Oct, 2019

Owner
Cumberland County

Construction Cost
$3.153M

Reference:
Mr. Jeffery Brown
Engineering & Infrastructure Director
Cumberland County Engineering and infrastructure
130 Gillespie St.
Fayetteville, NC 28301
Work: 910.678.7633
Jbrown@co.cumberland.nc.us

PROJECT DESCRIPTION

The Crown Coliseum in Fayetteville North Carolina is a 6,000 seat multi-use facility that is heavily used and is the home to the professional minor league Fayetteville Marksmen hockey team.

The facility had an aging R-22 based refrigeration system. The owner of the facility, Cumberland County hired B32 Engineering Group, Inc. to evaluate options for replacing the existing ice system which included the refrigeration system, the ice rink floor and the dasher board system. Options for ammonia, CO_2 and various synthetic refrigerants were presented to the County. The County selected ammonia refrigerant for its superior efficiency and sustainability, however, the refrigeration room was located in the center of the building on the second floor and shared space with most of the HVAC equipment for the facility. Due to code restrictions, the ammonia refrigeration room would have to be located elsewhere.

With B32s extensive experience in ice rink renovations they were able to present a solution that would place the ammonia refrigeration system in a new modular room outside the facility. The pipe routing between the new refrigeration room and the ice rink floor was the most challenging design element of this project. The project was a great success and will serve the facility well for the next 30 plus years.

Enterprise Center (St. Louis Blues) formerly Scottrade Center
St. Louis, Missouri

Facility Type
Professional - NHL

Expertise
Design, Construction

Status
Completed
Design 2017
Construction 2017

Owner
City of St. Louis

Construction Cost
$1.6M

Reference:
Doug Waugh
Sr. Director of Building Operations
Enterprise Center
1401 Clark, St. Louis MO 63103
314.589.5982
DWaugh@Enterprisecenter.com

Mark Bengard
Murphy Company
1233 N Price Road, St. Louis MO
314.997.6600
mbengard@murphy-stl.com

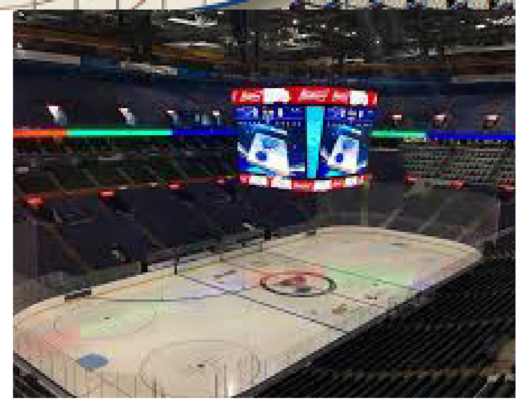
PROJECT DESCRIPTION

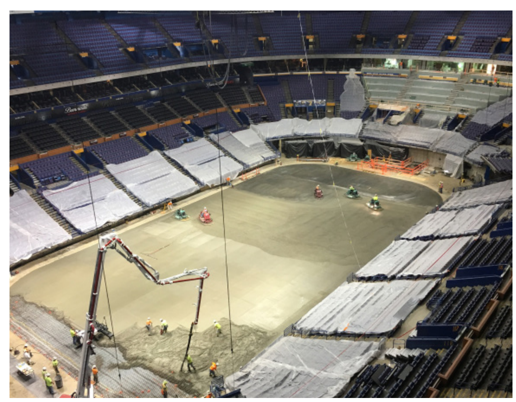
The Enterprise Center is best known as the home of the St. Louis Blues of the National Hockey League (NHL). The building was originally constructed in 1994 and the 23-year old ice and mechanical systems were starting to show their age and required replacement. Naturally, with an aging system, a number of issues began to crop up, including the deteriorating ice quality. This project had a number of unique challenges for the entire design team.

First and foremost, this project had a hard deadline due to the Enterprise Center being home to an NHL team. The project needed to be wrapped up by September for the 2017-2018 NHL season. With an already condensed schedule, the project wasn't approved to move forward until February of 2017. At this time, B32 Engineering Group was hired to design the new ice system including the rink floor and refrigeration system, and to work with a large local mechanical contractor, Murphy Company, who had limited ice rink experience. B32 Engineering Group designed the entire project in one month to assure material could be ordered and delivered on time for the 23 week project. The rink floor was constructed in half the time a typical floor takes.

Another unique challenge to this project was the need to have the rink floor change from NHL size (85' wide) to Olympic size (100' wide) with just a turn of a few valves. B32 Engineering Group floor design met this need and provided a very unique option for the owners and operators of this facility.

Due to the great success of this project, the Enterprise Center will provide an amazing ice surface for national and international events for many years to come.





Maryville University Hockey Center

Chesterfield, Missouri

September of 2019; the Maryville University Hockey Center was completed. The project includes a 2-sheet ice facility complex with all essential amenities; concessions/coffee shop, meeting facilities, viewing areas, and bar/dining area. The Complex provides needed ice time and recreational facilities for St. Louis youth and adults and attracts local and regional sporting events and tournaments, generating jobs and tourism dollars for local businesses.

Exploring Partnerships:

- Olympic figure skating training is considering a move to St. Louis, using non-peak hours and attracting top skaters and teams from around the country for US trials to this central location

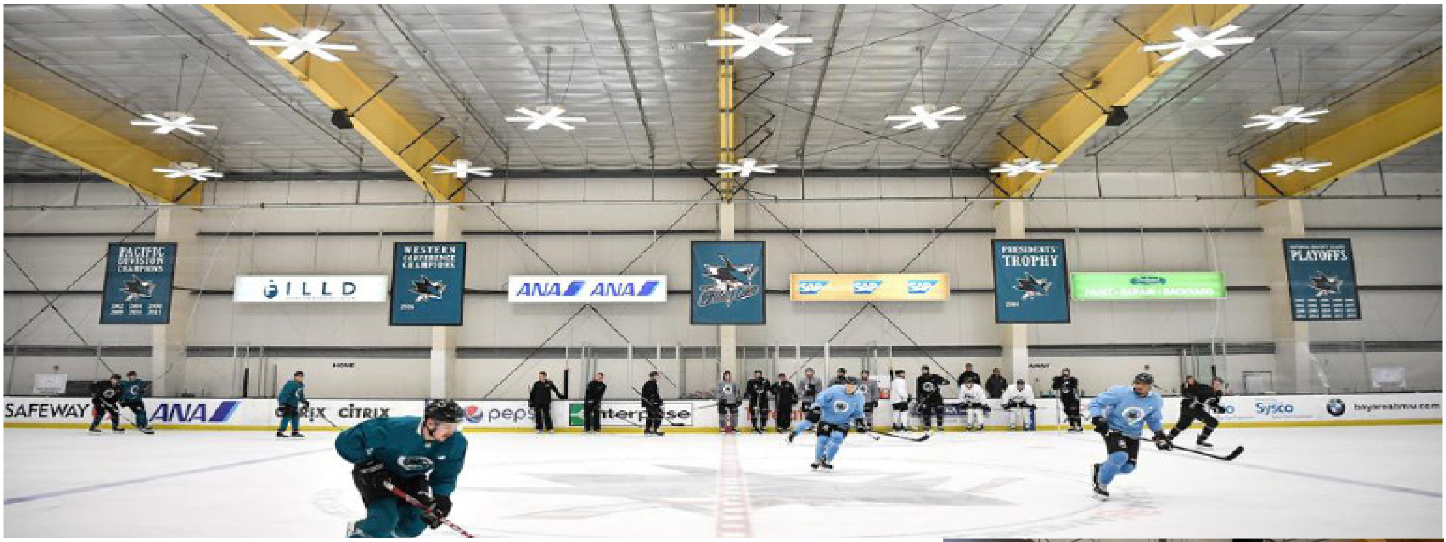
- St. Louis Curling Club is evaluating the construction of a facility adjacent to the Sports Complex, allowing resources to be combined and leveraging off one another to promote sports that are accessible to all people of all ages and abilities.

- Gateway Special Hockey and the St. Louis Sled Hockey Team have also expressed interest in the new facility

- During the off-season, one of the rinks will be converted for indoor soccer, box lacrosse, or ball hockey programs; further fulfilling the objective of involving more people in sports.

Chiodini ARCHITECTS

Solar4America - San Jose Rinks 1 & 2
San Jose, California



Facility Type
Professional NHL

Expertise
Ice System Design, Construction

Status
Completed
Design, 2017
Construction, 2018
Rinks 3,5,6 - 2020

Owner
City of San Jose

Construction Cost
General $2.5M
Ice System - $2.5M
Dasher Boards - $600K

Reference:
Jon Gustafson
Vice President
Sharks Ice LLC
1500 South 10th Street
San Jose, CA 95112
408.999.6751
jgustafson@sharksice.com

Reference:
Richard Rocha
Director of Building Operations and Guest Services
Sharks Ice LLC
1500 South 10th Street
San Jose, CA 95112
408.999.6719
rrocha@sharksice.com

PROJECT DESCRIPTION

Solar4America in San Jose is a non-stop facility, alive with community skating events, public skating, camps, youth and adult hockey games, etc. and is the largest indoor ice rink facility the Western United States. It is also serves as the training facility for the NHL San Jose Sharks, the AHL San Jose Barracuda, and the San Jose University Spartans hockey team. At the time of this renovation, the facility had 4 ice arenas and had plans for adding 2 more in the near future. Before looking too far ahead, there was a need to make improvements to the ice systems for Rinks 1 and 2. Rinks 1 and 2 were being served by a very efficient R-22 direct ice system that had well exceeded it expected and safe life.

B32 Engineering Group assisted the operational group in the design and construction administration services for a new ice system that included a common refrigeration system to serve the two ice rinks and two new concrete ice rink floors. The failure of the subfloor heating system in both ice rink floors allowed frost to build up under each ice rink floor 10 feet deep. B32 provided guidance on removing the frost during the demolishing phase as cost effectively and timely as possible using its extensive experience with frost removal. After discussing the refrigerant options for the new refrigeration system, a R-134a based refrigeration system was selected to serve these 2 rinks. With any renovation project come challenges and for this project the challenges included designing the new refrigeration system to fit in the existing refrigeration room, the new cooling tower to fit in the fixed space on the roof and a condensed project schedule required to meet the high demand for ice time. Careful planning was also required when designing the routing of the transmission mains in and around the existing building footings and walls. From start of construction to the start of skating on the new ice rink floors was 17 weeks. This very fast paced schedule required the experienced specialty services of B32 to stay on track, be flexible and make quick decisions and timely site visits during construction. The project was a huge success and met the Sharks Ice schedule and budget.

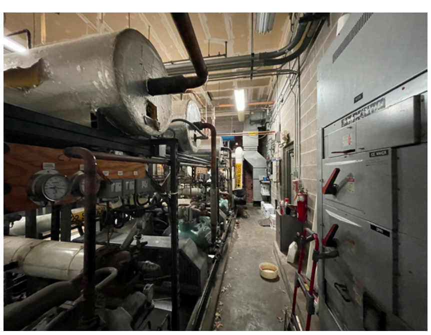
PROJECT UNDERSTANDING

As a continued effort to improve the operations and financial success of the Creve Coeur Ice Arena located at the Dielmann Recreational Complex at 11400 Olde Cabin Road, the City of Creve Coeur's Public Works and Recreation Departments is seeking request for qualifications for professional engineering services to review and evaluate the Ice Arena refrigerant system and develop a final recommendation for the feasibility of the refrigerant change. The selected engineering firm will then design the recommended system and provide all the necessary documents to bid its construction and installation. The existing ice rink floor and dasher board systems are not part of this project.

The facility has a solid and long tradition of providing ice-related activities including hockey, ice skating and curling. The highest level of play at this facility is high school practices. High School games are not played at this facility due to the limited seating.

The City has been proactive in evaluating and planning for improvements to the refrigeration system at this facility. The City hired this same B32 Engineering Group, Inc Team to complete an Ice Arena Refrigerant Change Feasibility Study in April, 2022 that evaluated the existing refrigeration system, presented four (4) options for improving the existing refrigeration system or replacing it with an new system, along with cost estimates and project schedules. Prior to the B32 study, Murphy Companies completed a study on the condition of the existing equipment.

The existing refrigeration system is an indirect R-22-based/glycol system that was installed in 2003 (19 years old). R-22 refrigerant used in the system was phased out of production in 2020, which has caused the price of R-22 to rise significantly over the past few years. Since 2003 there have been some major improvements to the existing refrigeration system such as rebuilding or replacing all three (3) Carlyle reciprocating compressors, installing a new evaporative condenser in 2008 (14 years old), adding heat to the snow melt pit, replacing the subfloor heating pump, etc. The existing refrigeration system has a capacity of approximately 120 tons. Waste heat is recovered from the system to serve the subfloor heating system under the ice rink floor and the snow melt pit in the resurfacer room.

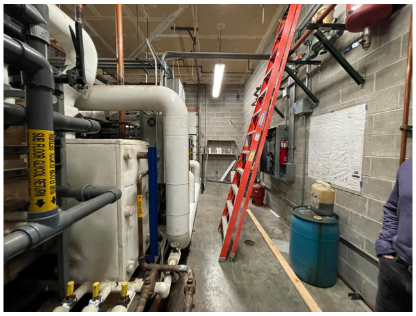


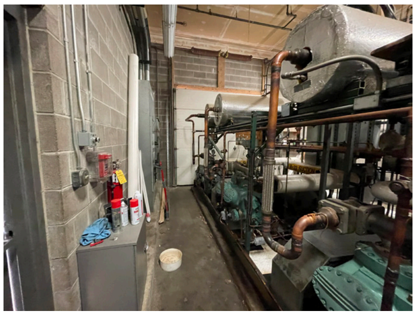
The existing refrigeration room is approximately 550 square feet which is adequate in size to house a new refrigeration system and the majority of the room construction is noncombustible. There is only one access door out of this room, and it opens directly to the exterior of the building. The existing life safety systems in the refrigeration room include a gas monitoring system and mechanical ventilation and are reportedly in good working order. This room should be updated to meet the current code requirements for the selected refrigerant.

This project presents numerous challenges, all of which the B32 Engineering Group Team has extensive experience with such as: renovation and design of recreation and park facilities (in particular ice arenas); building expansion and renovation; renovation of existing mechanical systems and building components; routing of new piping systems; the potential use of ammonia or CO2 and related life safety concerns; enhanced controls and interfacing with building management system; maximizing the use of waste heat; and proper system design and flowrates to help provide a high performing and efficient existing ice rink floor system. One of the most recent changes is the long lead times on some equipment. B32 has designed and bid numerous ice system projects over the past year or so and understands the supply shortages and options to lower the client's risk.

The City has applied for a St. Louis County Municipal Park Grant to fund part of the captial investment needed for this project. If grant funding is approved, we will work as part of the team to manage the grant requirements and provide the needed documentation. We will also appear as an expert before the City's Facilities Task Force and City Council and provide technical and financial recommendations.

WORK PLAN / SCOPE OF SERVICES





Using a proven, well-defined, step-by-step approach, we will work closely with the City of Crew Coeur, facility personnel and other stakeholders throughout the duration of the project.

The B32 Engineering Group Team will be led by Mr. Scott Ward who has extensive knowledge in ice arena facilities; ice system design, project development, funding applications, and the design and construction processes and is very familiar with the Creve Coeur Ice Arena. B32 understands the value in partnering with experts in the field and is therefore teaming with Chiodini Architects for architecture (extensive ice arena experience and will provide local representation) and G&W Engineering for MEP (extensive ice arena experience and can also provide local representation as needed). All meetings and discussions will be documented and meeting minutes will be distributed in a timely manner.

Project Schedule

Our team has extensive experience in working closely with clients to evaluate and identify renovation and improvement solutions for existing ice arenas and ice systems. We can provide a detailed project schedule that meets the City's goals and needs during our initial design meeting with the City.

With the current bidding climate, material supply shortages, and the number of ice rink projects scheduled for construction over the next few years, we recommend bidding this project in July of the previous year desired for construction. The longest lead items right now is Motor Control Centers (42 weeks). We understand the project schedule to be as follows:

- October 24 - City Council Meeting (award of contract)
- November 7 - January 31, 2023 - Part I Evaluation and Alternatives Feasibility Analysis.
- February 1, 2023 - April 28, 2023 - Part II Design and Bidding of Replacement System

The Proposed Work Plan for the design and construction phases of the project is presented in this section.

TASK A: Part I - Review and Preparation

To maximize the productivity of our first meeting, our team will review existing documents for the facility including drawings, specifications, reports and studies, utility bills, history of improvements, repair logs, etc.

TASK B: Part I - Evaluation and Alternatives Feasibility Analysis

This work will be completed in a step by step approach as outlined below.

STEP 1: Preliminary Walk-through of the Facility

The B32 Engineering Group Team is already very familiar with the facility but would like to walk through the facility again prior to our first meeting.

STEP 2: Project Kick-off Meeting

Introductory meeting with the City of Creve Coeur, City Project Manager, facility personnel, and other stakeholders to discuss the following:

- Introduction of all stakeholders and B32 Engineering Group team members
- Project goals
- Review two prior studies completed by Murphy and Chiodini.
- Project schedule.
- After completing a thorough discussion on the existing facility and its systems as well as, initial discussions on desired improvements, we will complete a field investigation of the existing facilities by each discipline and specialty required for scope of project, which may include site, building systems, ice systems, mechanical (HVAC), electrical, and structural.

- Interview of facility personnel. No one knows the facility and systems better than those who operate and maintain them. The unique design, character, and age of each ice arena facility make this information all the more valuable in completing a comprehensive study. Even though B32 knows your facility very well, we never stop learning. These interviews or discussions may be informal and take place over a period of time either in person, telephone or through electronic communications. Potential interviewees include: facility managers, equipment operation and maintenance staff, City design or engineering staff, outside service contractor (if it makes sense), etc.
- Perform on-the ground condition assessment of the existing refrigeration system, its components, related systems and components (architectural and MEP systems) and the facility general arrangements and operations.

STEP 3: Analysis and Technical Review of Feasible Options

With the collection of material and information complete a thorough process of analyzing and evaluating the information on the existing facility and proposed new systems will be performed. During this step we will:

- Evaluate refrigerant and refrigeration system and equipment options, waste heat recovery systems and other systems.
- Evaluate using the existing refrigeration room for the new refrigeration system and improvements required to meet current code requirements.
- Confirm the existing facility's ability to support the systems.
- Evaluate options on typical energy use, cost, and life safety.
- Evaluate impacts such as safety and environmental considerations and product quality.
- Identify and evaluate at least 3 options for replacing the refrigeration including the use of artificial refrigerants and natural refrigerants like ammonia and CO_2.
- Provide recent, actual applications both in the St. Louis area and nation wide for all options. We would be excited to organize and guide the City of Creve Coeur, facility personnel, and other interested stakeholders on a tour of any number of the B32 Engineering Groups Team's successful ice arena building renovation or new projects in the St. Louis area or set up tours for any of B32's very successful ice rink projects nationwide. This will provide you with the opportunity to see ice systems in operation and get feedback from facility staff. We have completed a number of community based facilities in the St. Louis area that are similar in size, function, and programming to the Creve Coeur Ice Arena.
- Provide opinions of construction costs for each option based on recent and current market conditions and B32's extensive ice rink project experience.
- Provide an accurate project timeline based on B32's extensive experience with ice rink projects. B32 typically has 10-15 ice rink projects under design or construction at any one time providing valuable information on the current status of materials, labor, etc. related to ice rink projects.

STEP 4: Final Recommendation

During this step we will:

- Coordinate with City staff findings and results of analysis with a final recommendation option for selection.
- Present selected option to Task Force, as needed.
- Make final presentation to City Council for approval consideration of the selected option.

TASK C: Design Phase - Design and Bidding of the Replacement

After acceptance of the Evaluation and Alternative Feasibility Analysis Phase by the City of Creve Coeur we will continue into the design phase.

STEP 1: Preliminary Design Phase (45% Complete)

With a defined scope, we will prepare preliminary design phase documents. During this step we will:

- Prepare Preliminary drawings for all systems and improvements including process, mechanical, electrical, piping, instrumentation and controls, fire protection, structural and all other drawings, narratives, spreadsheets, calculations, reports, and other elements as required for bidding and construction.
- Prepare draft of procurement and Division 1 documents.
- Prepare opinion of probable construction costs.
- Update detailed design development schedule that will plug into the anticipated project implementation schedule.
- Meet with the City to review the drawings, schedule and opinion of probable construction cost.
- Meet with local, State and Federal regulatory compliance agencies, including the Chief Building Official adn Fire Marshal, to review the proposed system design and
- Revise preliminary design phase documents, opinion of probable construction cost after meeting with the City and regulatory agencies.

Step 2: Final Design Phase (90% design review, 100% design)

After acceptance by the City of the Preliminary Design Phase Documents we will:

- Develop final specifications for improvements.
- Prepare final procurement and City documents.
- Provide a final opinion of probable construction costs.
- Update design development and project schedule.
- Meet with the City to review the plans at 90% complete, project schedule and estimate of probable construction costs.
- Revise bidding documents according to comments by the City and review agencies.
- Provide 100% final plans, specifications, and opinion of probable construction.
- Attend city council meeting(s) as necessary.

Step 3: Bidding Phase

During this step we will:

- Prepare advertisement for bid for the City to review and to provide to legal news publication and other trade magazines.
- Provide recommendation on bidding and award schedule.
- Provide three (3) copies of the bid documents to the City for the City's use.
- Provide three (3) copies of the bid documents to the City for permit review.
- Distribute copies of bid documents to the contractors.
- Answer questions from contractors, suppliers, and the City during the bid opening and record bid results.
- Attend pre-bid meeting and bid opening as desired by the City.
- Review the bid results and recommend award of construction contract.
- Prepare construction contracts for review by the City.

TASK D: Optional Construction Phase Services

Proper installation of the refrigeration system and related building, mechanical and electrical systems plays a significant role in the economic and social success of the ice arena facility. Experienced ice arena specialists provide a higher level of confidence that the installation has been done right and the final product has been constructed as the design intended.

We will provide the construction administration phase services necessary to monitor and document the construction of the project for the City and to help assure the project is very successful. There are numerous variables that will determine the number of inspections for the project including the scope of the project experience level and performance of the contractor. An outline of the typical construction phase services provided by our team for similar projects is presented below.

- Pre-construction Conference – To discuss the project requirements, expectations, communication, schedule, testing procedures, submittals, inspections, payment estimates and change order procedures.
- Progress Meetings - Coordinate and take part in regular progress meetings.
- Site Visits – The B32 Engineering Team will visit the site during the key construction activities. Outlined below examples of some of the more important milestones for the ice system and building addition:
  - Demolition and exposure of existing conditions.
  - Subgrade preparation of rink floors, footings, foundations, utilities.
  - Footing and foundation installation; utility installation.
  - Refrigeration equipment inspection - Observe installation of refrigeration equipment, piping, controls, and other systems within the mechanical room. Check equipment and piping clearances, piping supports, material conformance, etc. Perform a preliminary check of the dasher board installation after the concrete ice floor has been installed and cured.
  - Building system installation including walls, roof, flooring.
  - Mechanical and electrical system installations.
  - Final inspection/equipment start-up - Perform a final walk through of the systems generating a list of items (punch list) to be completed. Review start up and shut down procedures. Review Operation and Maintenance manuals provided by the contractor.
- Contract Administration - We will also provide shop drawing review of equipment and materials used on the project. We will perform construction administration tasks such as reviewing and processing pay requests, change orders and documenting the project's progress. We will provide the City with a Field Observation report for each site visit.

B32° Engineering Group

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