STAFF REPORT TO THE SOOKE & ELECTORAL AREA PARKS AND RECREATION COMMISSION SPECIAL MEETING OF FEBRUARY 24, 2014

SUBJECT: A-20 Desiccant Dehumidifier Installation

PURPOSE/ISSUE:

On December 4, 2013 a report was brought forward to the Commission regarding the SEAPARC arena desiccant dehumidification. The Commission directed staff to purchase an A-20 dehumidifier, purchase a new conventional dehumidifier and to call for tenders for the installation of said units. The following report addresses this request.

BACKGROUND:

With the challenges associated with the A-5 currently in place, it was recommended by CRD engineering to have an independent consultant review the project. AME Group Consulting Professional Engineers provided an arena dehumidification assessment (attached Appendix A). The assessment concluded that an A-20 will meet the needs of the aging arena.

To provide more efficient dehumidification and more capacity the A5 should be left in place. The original thought was to remove the A5 and replace it with a conventional dehumidifier. This was presented to provide a price credit and cost savings. After the removal and shipping of the A-5 this option would not equate to cost savings. Additionally the A-5 is a more effective dehumidification unit than a conventional unit. A5 unit will provide 25 lbs/hr of moisture removal which is sufficient for backup purposes during non-peak loads, (ie. approximately 80 - 90% of ice operations).

The next phase of the SEAPARC dehumidification project is to address the following:

1.) A quote from AME Group Consulting Professional Engineers has been received for the design and installation of the A-20 (attached Appendix B).

2.) Munters provided the opportunity to add additional options on the A-20. These options are for the capability of heating and cooling and do not include the heating or cooling source.
- Heating and cooling capability 7500 CFM $12,864
- Heating /7500 CFM $8,576

The manufacturer recommends an increased desiccant wheel size and increased CFM if equipment is to provide space cooling or heating functions. Additional costs only encompass heating, and/or cooling coils, enlarged wheel and additional CFM. Additional costs do not include provision of heat/cooling energy source or controls. Use of heat during ice-in is estimated to increase refrigeration load 8% per degree of temperature increase.

3.) Accent Refrigeration will commission the A-20 startup and calibration $3000

ANALYSIS:

1.) If the installation is not properly designed, the unit may not function or fail to function to its maximum capacity. The design and install is very important and should be carefully considered. AME will work with both the owner and the vendor to ensure the design will meet the needs of the arena.

2.) At this point in time I would not recommend additional heating and cooling coils. If we are looking at the heating and cooling of the arena space we should examine a system that is designed to work for that area. This heating set up will be very expensive. Use of heat during ice-in is estimated to increase refrigeration load 8% per degree of temperature increase.
3.) Proper calibration and set up will be required when maximum demand is placed on the unit. Accent is the licensed dealer for Munters products this will ensure our warranty is valid on the unit.

BUDGET

In 2013, $85,000 was originally budgeted for the completion of the work. The following highlighted items are new and have increased the cost of the project by $14,700. We have also added $5,000 to the install budget line item for additional ducting, should it be required.

Arena Dehumidification Project Budget

A20 Dehumidifier	$ 58,960
Shipping	4,500
Install – Electrical, Gas Line, Ducting, Concrete, etc.	25,000*
AME – Design/Install Engineering	11,500
CRD – Project Engineer	3,200
Accent Refrigeration – Commissioning, start-up and controls	3,000
Base Budget Total	$106,160
Original Budget Total	$ 85,000

- Equipment costs are payable in USD, pricing in CAD provided at $1.072 CAD per $1 USD
- Shipping is FOB Origin, risk is assumed by SEAPARC once equipment is shipped
- *Install costs are estimates and encompasses all costs except equipment, engineering and commissioning

CONCLUSION:

The SEAPARC A-20 Desiccant is intended to address excess arena humidity during seasonal peak periods. This issue is detrimental to the ice quailty and is a safety hazard for staff and public. The A-20 satisfies this requirement. To ensure the unit performs correctly, the design and installation should be professionally overseen. Further more, the start up and comissioning must be completed by Accent to ensure correct operation and warranty.

Current project timeline:

- Order A-20 February 25th 2014
- Secure AME Group Consulting for design and install February 25th 2014
- Desiccant installed in June 2014.

RECOMMENDATION:

That the Commission approve the purchase of the A-20 unit and AME's proposal for the design and install and that $106,600 be accessed from Capital Reserve funds to complete the SEAPARC A-20 desiccant dehumidification project.

Steve Knoke
SEAPARC Manager

APPENDIX A

AME Group
Consulting Professional Engineers

ARENA DEHUMIDIFICATION ASSESSMENT REPORT

SEAPARC Leisure Complex

Prepared For:

Capital Regional District
625 Fisgard Street, PO Box 1000
Victoria, BC V8W 2S6

c/o Andy Liu, P.Eng.,
Manager, Environmental Engineering

Victoria Office:
721 Johnson St
Victoria, B. C. V8W 1M8
Ph. 250-382-5999
Fax 250-382-5998

Vancouver Office:
1100 – 808 West Hastings St
Vancouver, B. C. V6C 2X4
Ph. 604-684-5995
Fax 604-684-5993

Prepared By:
Cassidy Taylor, P.Eng., Associate

Peer Review By:
Rob Walter, Eng. L., A.Sc.T, Principal

Project No. 000a_314_14
February 18th, 2014

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EXECUTIVE SUMMARY

The current dehumidification at the arena located at the SEAPARC Leisure Complex consists of two gas-fired dehumidification units. One is a newer unit installed in 2009 as part of the arena design-build renovations. The other is one of the existing units that was scheduled for replacement in 2009, but was still functional, and the facility decided to retain the unit for use as a back-up.

The combined moisture removal capacity of the two units is estimated to be approximately 36 lbs/hour. Using Munters calculation method for moisture load, it is estimated that the dehumidification load is somewhere between 90 and 125 lb/hour, depending on the actual tightness of the construction. The looser the construction, the more infiltration into the arena, and the more humidity load in the space.

A Munters A20 dehumidifier is recommended for installation to meet the dehumidification load. Proper installation of the equipment, including proper ductwork distribution and additional circulation fans, should result in the dehumidification load being met in all but the most extreme temperatures.

As much as possible, recommendations in Chatwin's report should be implemented as they should have a positive effect on the performance of the dehumidification system.

Lastly, it is recommended to review and remediate the pressure zones with the building to ensure that there is a negative pressure in the pool relative to the lobby and a positive pressure in the arena relative to the lobby. The former should ensure corrosive pool air is not allowed to travel elsewhere in the building, and the latter should ensure that humidity is not allowed to travel into the arena from elsewhere in the building.

1.0 INTRODUCTION

The AME Consulting Group was commissioned by the Capital Regional District to assess the arena dehumidification system at the SEAPARC Leisure Complex, located in Sooke, BC, and make recommendations with the intent to improve the system's performance.

The facility was built in 1975 and largely remains as per the original design. A study and design was conducted by Hirschfield Williams Timmins (HWT) Ltd. in 2006, but was not implemented at that time. Since the renovations, the arena environment has improved, but issues still remain.

In 2009 and 2010 two major renovations were conducted in sequence:

1. A design-build project to implement heat recovery from the ice plant for use in the facility that included replacement of an existing dehumidification unit with new equipment.
2. A design bid project to add new arena changerooms and re-work the ventilation in the existing changerooms and lobby.

The current dehumidification at the arena located at the SEAPARC Leisure Complex consists of two gas-fired dehumidification units. One is a newer unit installed in 2009 as part of the arena design-build renovations. The other is one of the existing units that was retained for use as a back-up.

The purpose of this report is to relate the findings of the assessment performed by the AME Group, in order to further guide any required facility remediation work. Specifically:

- It will discuss the current dehumidification sizing.
- It will discuss aspects of the arena's construction that affect the indoor environment.
- It will provide recommendations moving forward to improve the performance of the dehumidification system. While it will discuss potential remedial measures, the full design for these measures is beyond the scope of the current report.

2.0 APPROACH

2.1 General

Our approach to conducting the feasibility assessment was to visit the facility to discuss with facility staff, and complete a walk-through of the spaces, making observations.

Lastly we have also applied our professional engineering judgement and experience with respect to arena dehumidification.

2.2 Site Visit

The site visit was conducted on January 27th, 2014 by Cassidy Taylor, P.Eng., of the AME Consulting Group, to observe and confirm the general arrangement of the mechanical systems and the condition of the facility. The site visit was limited to visual observations only, and no destructive testing or disassembly of equipment, or operational manipulation, was undertaken.

The following was noted during the site visit:

- Both of the installed dehumidification units discharge directly into the arena, with little to diffuse the air and ensure proper circulation within the arena.
- A pressure differential exists between the lobby and the arena, and likely between the pool and lobby.
- Corrosion on the roof structure appears to decrease as one moves further away from the arena lobby.
- The building is nearing 40 years in age, and as is to be expected with a building of this vintage, there is some structural and envelope degradation that is resulting in uncontrolled infiltration and ingress of environmental elements.

3.0 DISCUSSION AND RECOMMENDATIONS

3.1 Construction

The general condition of the arena is described in depth in a 2012 report entitled *"SEAPARC Leisure Complex – Building Envelope Condition Assessment"* prepared by Chatwin Associates Building Engineering Ltd. Several issues with the building envelope are noted in the report:

- The building is considered to be "very leaky", with loose construction observed in the roof and wall assemblies. This is in line with the design standards in place in 1975, when the facility was built, but does not meet current performance standards.
- The roof insulation over the arena has many puck punctures in the vapour barrier, located on the arena side of the insulation.

The presence of both of these situations has an influence on the indoor environment in the arena, which is detrimental when the weather is not favourable, and reduces the load on the dehumidification plant when the weather is cold. This latter effect is not necessarily as helpful as it may first appear, as it is still an uncontrolled interaction.

AME Recommendation: Due to the vintage of the building, AME doesn't have additional recommendations for remediation of the building envelope or structure beyond what was recommended in Chatwin's report. Any large sources of infiltration are recommended to be addressed to minimize their effects on the indoor environment. Puck punctures of the vapour barrier should continue to be repaired as often as possible to minimize detrimental effects on the indoor environment.

3.2 Facility Comparison

Based on the information gathered during, and provided to AME following, the site visit, the following table summarizes the facility's current dehumidification system and compares with the recommended size.

	Original Equipment (pre-2009)	Current Equipment (Estimate)	Recommended
Dehumidification Capacity[1] (estimate in lbs/hr)	22[2]	36[3]	100

Notes:

1. *Based on summer design temperatures of 70F/61F (db/wb) and indoor conditions of 55F (db) and 50% RH.*
2. *Approximation based on performance data for two Cimco Humicon MK VIII (replaced the MK VII).*
3. *Approximation based on one Cimco MK VII and one Munters A5.*

3.3 Arena Dehumidifiers

3.3.1 General:

The original HWT design included the installation of two dehumidifier options:

1. Bry-Air model #VFB-36, rated to remove 28 lbs of moisture per hour from the space, or

2. Concepts & Designs DH-130, rated to remove 22.2 lbs of moisture per hour from the space.

Both of the suggested options are in the same range as the original equipment sizing. It is assumed that the sizing was calculated at the time of design and deemed to still be adequate. When the replacement of the dehumidifier went ahead in 2009, it is again assumed that the sizing of the replacement equipment was to match the existing unit.

At the conclusion of the 2009 project, the dehumidification equipment was as described in the following sections.

3.3.2 Existing Dehumidifier:

The existing dehumidifier is a gas-fired, Cimco Humicon model #MK VII, rated to remove approximately 11 lbs of moisture per hour from the space. There is no ductwork to or from the unit; it discharges directly to, and pulls directly from, the arena bowl. It is located on a platform above the visitors' bench.

Fig. 1 – Existing Dehumidifer

3.3.3 New Dehumidifier:

The new dehumidifier is a gas-fired, Munters model #A5, rated to remove 25 lbs per hour of moisture from the space. As with the existing unit, there is no significant ductwork to or from the unit, though an elbow was added after installation, with the intent to direct the discharging air from the unit. It is located on a platform above the home bench.

Fig. 2 – Munters Dehumidifier installed in 2009

AME Recommendation: Due to the loose construction of the building (see section 3.3 below), there is a significant infiltration load being introduced to the arena that was likely not included in the 2006 design calculations, nor in 2009. If we even assume, as a best case, that the building construction tightness is now 'average', the estimated dehumidification load is approximately 90 lbs/hr. If we assume that the building construction tightness is now 'loose', the estimated dehumidification load jumps to approximately 125 lbs/hr. It is to be noted that both of these calculations are based on the summer design temperatures from the BC Building Code, and as such, are expected to occur only 2.5% of the year.

The conclusion that is reached from here is that a single Munters A10 unit, rated at 75 lbs of moisture removal per hour, should be able to meet the dehumidification load for a majority of the time. However, it will not be able to meet the full dehumidification demand when the weather is not favourable. This is expected to occur during the summer, and periodically during the spring and fall. As the former tends to be when playoffs are occurring and the latter tends to be when ice is being put in for the year, it is recommended to install the next largest size of Munters unit, the A20.

Another option under discussion is to keep the existing A5 unit, and supplement it with either a new A10, or a new A20. AME's understanding of the conversations between facility staff and the local Munters representative is that doing so would likely result in the A5 sitting idle for long periods of time. In addition, combining an A5 and an A10 would increase the amount of time the dehumidification load is being met, but with a combined capacity of 100 lbs/hr of moisture removal, there would likely still be times during the year when the full load cannot be removed. As such, this option is not recommended due to potential inability to meet demand load, and issues with leaving the unit idle.

Thought should be given to installing the new equipment outside the arena bowl. Structural supports in the arena are recommended to be removed if they are no longer being used. Any new equipment should be have proper ductwork distribution installed to ensure optimal distribution and circulation of the dry air discharged by the dehumidification equipment.

In addition, it is recommended that circulation fans be installed at strategic locations within the arena to further assist in the distribution and circulation of the dehumidifying air. If the ductwork is installed in a fashion similar to that described in HWT's design, then installation of a minimum of three circulation fans is

recommended. If the ductwork can be installed in a more effective manner, the number of fans may be reduced.

3.4 Facility Pressurization

The report prepared by Chatwin also discusses signs of corrosion in the entrance lobby and hypothesizes that there may be a pressurization issue in the facility that is resulting in corrosion pool hall air being transferred into the lobby. Corrosion can be seen on metal elements both in the lobby and the natatorium viewing area, as well as in the hallway adjacent to the administration offices.

This was observed during the site visit at the doors between the arena viewing area and the lobby. It is AME's understanding that these doors used to be kept closed most of the time, but are now held open during operating hours. Opening and closing the doors allows one to demonstrate a pressure differential exists between the two spaces. This transfer of air within the facility allows corrosive air to travel from the pool hall throughout the building, including into the arena. This helps to explain the corrosion in the arena being most prevalent nearest to the lobby, and decreasing as one moves further away.

Fig. 3 – Corrosion on Arena Structure Facing Away from Lobby

Two existing, roof-mounted exhaust fans serve the arena, exhausting air from the space when sensors detect carbon monoxide. It is not AME's conclusion that the negative pressure that results when these fans turn on is responsible for the corrosion. If it were, then one would expect the corrosion in the arena to be observed more evenly throughout the arena.

Fig. 4 – Existing Arena Exhaust Fan

AME recommendation: It is recommended that the pressure differentials both with individual spaces, but also between spaces be measured and confirmed as follows:

- Pressure in the natatorium is to be slightly negative. Typically this is achieved by exhausting approximately 10% more air than is being supplied to the pool. The current design of the pool ventilation is to be reviewed in greater detail to ensure no issues are introduced during this remediation.

- The natatorium is to be held at a negative pressure differential relative to the lobby. This serves to make use of the natatorium ventilation equipment running as noted above and further prevents the migration of corrosive air from the natatorium.

- The arena is to be held at a positive pressure differential relative to the lobby. This serves to prevent corrosive air from traveling into the arena from the natatorium, but also serves to prevent migration of humidity from lobby to the arena.

- Pressure within the arena is to be slightly positive. As the dehumidification units are single fan systems, this should be achieved fairly easily by correcting the pressures in adjacent spaces within the facility. This will also help to reduce infiltration of outside air into the arena. The success of this last point will be heavily affected by the extent of any remediation to the

envelope. If no remediation is performed, then the reduction from a positive pressure within the space will be less.

It is further recommended that weather-stripping and door sweeps be remediated or re-installed on all doors between the lobby and the arena, and on all doors between the arena bowl and the viewing area.

4.0 CONCLUSIONS

Since the replacement project conducted in 2009, the arena environment has improved, but issues still remain. The existing dehumidification units at the SEAPARC Leisure Complex have continued to underperform, notably when the weather is unfavourable.

By making some educated assumptions on the current building construction tightness based on Chatwin's building assessment report, AME estimates the dehumidification load within the space to have increased since the original design. A Munters A20 dehumidifier is recommended for installation to meet the dehumidification load. Proper installation of the equipment, including proper ductwork distribution and additional circulation fans, should result in the dehumidification load being met in all but the most extreme temperatures.

As much as possible, recommendations in Chatwin's report should be implemented as they should have a positive effect on the performance of the dehumidification system.

Lastly, it is recommended to review and remediate the pressure zones with the building to ensure that there is a negative pressure in the pool relative to the lobby and a positive pressure in the arena relative to the lobby. The former should ensure corrosive pool air is not allowed to travel elsewhere in the building, and the latter should ensure that humidity is not allowed to travel into the arena from elsewhere in the building.

AME Group
Consulting Professional Engineers

February 18, 2014

Capital Regional District
625 Fisgard St., PO Box 1000
Victoria, BC, V8W 2S6

File: P14-032
Email: aliu@crd.bc.ca
Ph: 250-360-3268

Attention: **Andy Liu, P.Eng., CEM, Manager, Environmental Engineering**

Re: **Seaparc Leisure Complex – Dehumidification Design**

Dear Andy,

Thank you for considering us for this proposal. We are pleased to offer our professional services for this project and look forward to continued work at the Seaparc Leisure Complex.

Project Understanding:

Our understanding of the project is based on discussions between CRD and AME, as well as our report on the dehumidification system assessment. The following fee proposal is for the implementation of the recommendations put forth in that report. We have dedicated time available for this project and can start immediately upon approval.

Mechanical Consulting Services:

Scope of Work Included:

Dehumidification System:

Full service design and construction administration for the dehumidification systems, including the following:

- ✓ Full documentation (drawings and specifications) for the dehumidification system design including ductwork distribution.
- ✓ Coordination of design with other Consultants.
- ✓ Attendance at one (1) design meeting and two (2) construction inspections
- ✓ Letters of Assurance and all close-out documentation
- ✓ Site reports, change notices and review of relevant shop drawings and progress draws.

Building Pressurization:

Preparation of evaluation and trouble-shooting methodology for the facility pressurization issues noted in the report, including:

- ✓ Preparing investigative plan
- ✓ Coordination/implementation of plan with balancing agent hired by SEAPARC
- ✓ Analyzing data
- ✓ Preparation of report summarizing results and recommendations for remediation.

Excluded Services:

None of the following services are to be considered as part of this proposal:

- All engineering of a non-mechanical nature or not directly related to dehumidification, including plumbing, fire protection, acoustic, structural (seismic), electrical, civil, architectural, etc.
- Site visits and meetings beyond those listed above.
- Production of CAD record drawings.
- Detailed Construction Documents to facilitate competitive tender of the work.
- Any work not listed as included within our basic services scope

Professional Compensation:

Our fixed fee breakdown for mechanical consulting services shall be as follows:

Dehumidification System:

Working Drawings	$5,325
Tender	$500
Construction Administration*	$3,900
BASIC SERVICES TOTAL	**$9,725**

* Construction Administration: services are limited to in-office services (shop drawing reviews, progress claim reviews and preparation of field reports) and three (3) site visits (one during design; two during construction). Any additional site visits or meetings required will be invoiced at $650.00 per visit, plus disbursements as noted below.

Building Pressurization:

Our fee for mechanical consulting services as described above shall be **$3,600.00** and includes two (2) site visits or meetings. Any additional site visits or meetings required will be invoiced at $650.00 per visit, plus disbursements as noted below.

Disbursements:

Disbursements for the cost of the reproduction of drawings, long distance calls, courier services, etc., shall be in addition to the above at cost plus ten percent (10%) for handling.

Standard Hourly Rates:

Any additional services required will be at standard ACEC-BC recommended hourly rates. The rates are effective until the end of the project.

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Principal	$200.00
Associate	$160.00
Project Manager	$140.00
Senior Engineer	$120.00
Junior Engineer/Senior Technologist	$100.00
Junior Technologist	$80.00
Administration	$60.00

Contract Terms:

Our invoice will be issued upon delivery of the report and is due upon receipt. Monthly interest of 1.5 percent will be charged on outstanding invoices over 30 days. All applicable taxes are not included in the fee amounts presented above and will be added to invoices as applicable.

In absence of any formal contract, this agreement shall conform to the terms and conditions set out in the Association of Consulting Engineers of Canada (ACEC) 31, Prime Agreement between Client and Engineer and as indicated within this proposal.

We are looking forward to the opportunity of working with you. For our files, please sign and return a copy of this letter indicating your acceptance of the above proposal.

Trusting the above meets your approval, we remain,

Yours very truly,
The AME Consulting Group Ltd.
Victoria, BC

Cassidy Taylor, P.Eng., LEED AP
Associate

AME Group
Consulting Professional Engineers

FEE AGREEMENT ACCEPTANCE

PROPOSAL:	SEAPARC Dehumidification Design
PROPOSAL NO:	P14-032
PROPOSAL DATE:	Feburary 18, 2014
PROPOSAL SUBMITTED TO:	Andy Liu, P.Eng. **Manager, Environmental Engineering, Capital Regional District**

We have reviewed the fee proposal submitted by The AME Consulting Group Ltd., and are in agreement with the indicated fee for the above project based upon the outlined scope of work included.

COMPANY:	**Capital Regional District – SEAPARC**
ADDRESS:	
AUTHORIZED PERSONNEL:	
SIGNATURE:	
DATE:	
FEE:	$

Indicate acceptance of selected services below:

ACCEPTED: YES__ NO__	Dehumidification Design ($9,725)
ACCEPTED: YES__ NO__	Building Pressurization ($3,600)

The AME Consulting Group GST Number is: 827965278
The AME Consulting Group Worksafe BC Number is: 748886