MacPHERSON Engineering Inc.

220 - 2365 Albert Street, Regina, Sk, S4P 4K1
Phone (306) 586-7972
Fax (306) 586-5568

May 22, 2013

City of Regina
Facilities Engineering, Facilities Management Services

Attention: Jamie Hanson jhanson@regina.ca
Manager, Facilities Engineering

Re: Lawson Aquatic Centre

Dear Jamie:

Our report regarding the Lawson Aquatic Centre pool cell ventilation system is attached. Please let me know if you have any questions or would like to meet to further discuss the content of the report.

Yours truly,

MacPHERSON ENGINEERING INC.

28(1) Signature removed

Murdoch MacPherson, P.Eng.

1. Objective of Report

MacPherson Engineering Inc. met with the City of Regina facilities personnel on March 28th, 2013 and were asked to review the pool cell ventilation system operation at the Lawson Aquatic Centre to determine if it is operating as designed/intended and to assess system design, capacity and operation for daily use and larger events.

2. Overview of Ventilation System

The Pool Cell ventilation system consists of make-up air units MUA-2 (constant volume), MUA-3 (dual volume), auxiliary outdoor air dampers and exhaust fans EX-6A, EX-6B, EX-7A, EX-7B. The make-up air units draw 100% outside air, heat it up to room temperature and deliver it via ductwork to the pool cell area. The exhaust fans draw an equal amount of air from the pool cell area and exhaust it directly outdoors. The auxiliary outdoor air dampers are normally closed but will open automatically if the make-up air units and exhaust fans are operating at maximum capacity and the space relative humidity setpoint cannot be achieved.

The system is enabled to automatically control building relative humidity levels through the Building Management System (BMS) according to an occupancy time schedule, currently set to operate from 5:00am to 11:00pm daily. During unoccupied hours, the system is programmed to start automatically if space relative humidity levels go out of range.

The temperature of the supply air discharged from MUA-2 and MUA-3 is automatically reset based on the outside air temperature. The base supply air temperature setpoint would typically be 80 deg F. As the outside temperature drops in the winter, this would reset up to a maximum of 85 deg F. In the summer as the outside air temperature rises, this setpoint would reduce to approximately 75 deg F.

Space relative humidity is controlled by automatically adjusting the amount of outside air ventilation being used through staging of the make-up air units, exhaust fans and auxiliary outdoor air dampers. Space relative humidity is measured by combination humidity/temperature sensors located on the north & south walls at the east (exhaust) end of the pool.

The outside air ventilation equipment is staged as follows by the BMS to maintain the space relative humidity at setpoint, currently set at 45% RH.

STAGE	MAKE-UP AIR UNITS			EXHAUST FANS				OUTSIDE AIR DAMPERS
	MUA-3 (LOW)	MUA-3 (HIGH)	MUA-2	EX-6A	EX-6B	EX-7A	EX-7B	
1	ON	OFF	OFF	ON	ON	OFF	OFF	CLOSED
2	ON	ON	OFF	ON	ON	ON	OFF	CLOSED
3	ON	ON	ON	ON	ON	ON	OFF	CLOSED
4	ON	ON	ON	ON	ON	ON	ON	OPEN

The operation of the ventilation equipment is remotely monitored and alarmed through the BMS. An alarm is generated if any of the following conditions occur:

-Supply fan failure.
-Low discharge temperature alarm.
-Dirty filter.

Also, the status of the make-up air units and exhaust fans is monitored at the BMS:

-MUA-2, MUA-3 supply air temperature
-MUA-2, MUA-3 operational status (on / off)
-EX-6A, 6B, 7A, 7B operational status (on / off)

3. Assessment of System

General

At the time of our site visit, we noted that the ventilation equipment was operating. While on site, the BMS monitoring and alarm interface was not functioning properly and was in the process of being examined by a Controls service company.

We recommend that when the BMS system has been repaired, the ventilation system be shut down for a period of time, then restarted. The operation of the make-up air units and exhaust fans should be physically observed to confirm that they stage in accordance with the chart above to maintain the space relative humidity at setpoint. During this test, space temperature and relative humidity should be monitored by portable equipment in order to confirm the BMS readings. The BMS should also be set up to trend the operation of the equipment and the space temperature and humidity.

Compliance with Current Codes & Standards

The National Building Code (NBC 2010) references that outdoor air minimum ventilation rates meet the minimum requirements of ASHRAE Standard 62 "Ventilation for Acceptable Indoor Air Quality". The version of this Standard referenced by NBC 2010 (ASHRAE Standard 62-2001) dictates for natatorium pool & deck areas, a minimum outside air ventilation rate of 0.5 cfm/sq ft. to adequately dilute contaminants generated by pool water and to provide acceptable indoor air quality conditions.

At stage 1 according to the chart above, the Lawson Pool cell ventilation system exceeds the NBC 2010 requirements. When the Lawson Pool cell ventilation system ramps up to maximum capacity, it will provide an outdoor air ventilation rate of 1.8 cfm / sq ft or over three times the minimum code requirement.

4. Recommendations

1. Consideration should be given to installing carbon dioxide (CO_2) sensors in the pool cell area and automatically overriding the ventilation system staging controls to increase outside air ventilation on detection of high CO_2 levels. Measured CO_2

levels within the space are a good indication of whether the ventilation system is providing sufficient outside air to satisfy the occupants within the facility. Typically, the CO_2 levels in the space should not exceed 800ppm. If they rise above 800ppm, the outside air ventilation rate should automatically be increased. If the levels cannot be reduced, an alarm through the BMS would be generated.

2. In the short term, before the above recommendations have been implemented, the pool cell area ventilation systems should be manually overridden to STAGE 3 during events where large numbers of competitors and spectators (over 500) are present. This override should be activated approximately 8 hours before the event starts. This will provide more outside air ventilation and generate more air movement in the pool cell to satisfy the building occupants and dilute contaminants generated by pool water.

3. In the short term during events where large numbers of competitors and spectators are present, consideration should be given to providing one or two portable horizontal 42" variable speed propeller fans to provide air circulation at the exhaust end of the pool, particularly under the diving platform. The exact position and speed setting of the fans would have to be determined on site so that uncomfortable drafts are not created for occupants. It is not recommended that exterior doors be propped open, primarily for building security and egress safety issues.

4. ASHRAE also publishes Handbooks with guidelines and recommendations for the design of HVAC systems for various types of buildings. The 2007 HVAC APPLICATIONS handbook recommends that the "air delivery rate" of a mixture of outside air and recirculated air for natatoriums with spectator areas be between 6 and 8 air changes per hour in order to adequately control temperature and humidity. On average throughout the pool cell, the air will get completely replaced with heated outside air in approximately 30 minutes when the system is operating on stage 4 high capacity.

   In the longer term, consideration should be given to designing and installing variable speed circulation fans suspended at high level within the pool cell. The fan speeds should be adjusted to provide air movement across the spectator and pool deck areas and limited air movement across the pool surface to disperse contaminants in the occupant breathing zone. A similar approach is currently being implemented for the two new facilities being constructed in Ontario for the 2015 Pan Am Games to satisfy ASHRAE recommendations with respect to air delivery rates.