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Town of Sudbury
Building Department
270 Old Lancaster Road
Sudbury, Massachusetts 01776

February 10, 2012

Attention: Mr. Jim Kelly

Subject: Atkinson Pool Conditioning System
Sudbury, Massachusetts

Dear Mr. Kelly,

The new dehumidification/heating/cooling system for the natatorium will fall into one of two categories. There is more than one option in each category, but those refinements can be made after the initial bid, if required.

Category 1: Air to Air Heat Exchanger

The system currently serving the natatorium is an air to air heat exchanger equipped with a natural gas fired duct furnace. The system has exceeded its useful service life, is not working properly and is beyond repair.

Air to air heat exchangers are utilized to provide dehumidification for natatoriums during winter operation because they minimize electric consumption and utilize fossil fuel to provide heat. They are a low operating cost option where natural gas is available and can be very effective for natatoriums located in regions which do not experience a high outdoor relative humidity or extended periods of high temperature in the summer. In the winter, the very dry outdoor air is brought into the building to lower the indoor humidity through the heat exchanger and is preheated by the exhaust air, saving as much as 60% of the heating energy. The remainder of the heat required to maintain the temperature in the natatorium is provided by a secondary heater such as a hot water coil served by a boiler or, as in this case, a gas fired duct furnace.

The total owning cost, including initial cost and ongoing costs, of this type of system is lower than that of a compressorized system. The initial cost of the system is approximately $80,000 less than that of a compressorized system (this can vary significantly depending on various options.) There are two components to the lower ongoing cost; lower energy cost and lower maintenance cost. Since this type of system does not employ compressors to provide dehumidification, the attendant maintenance, service and repair cost issues associated with refrigeration systems are eliminated. Airside maintenance is less critical since there is no refrigeration system, and any lapses in maintenance are less critical because they cannot cause a high cost system failure. The belts and filters must still be maintained for an air-to-air system, but the impact of improperly doing so is not as severe and usually includes only a downgrade in performance until the problems are corrected. The energy cost savings can be significant since fossil fuel for supplemental heating and pool water heating is substituted for electrical consumption by a compressorized system.

The drawback to a non-compressorized system is that if there is an extended period of high summer outdoor humidity and/or temperature, and cooling is required, it becomes impossible to properly cool and/or dehumidify the natatorium. This may not be an issue in a building with a low summer use, but for a building that is intended to be used extensively during the summer it's probably wise to consider a different type of unit.

Category 2: Compressorized Unit

A compressorized dehumidification unit uses a refrigerant compression cycle to cool and dehumidify the air. During periods in which cooling is not required but dehumidification is required, the cooling system runs to dehumidify the indoor air and the heat extracted from the space during the dehumidification process is used to maintain space temperature and keep the pool water heated. When cooling is required, the heat can either be dumped into the pool water or can be rejected to the outdoor air using an outdoor air cooled condenser or outdoor air drycooler.

A properly maintained compressorized unit will be able to maintain precise indoor air temperature and humidity under all outdoor air and occupancy conditions. The drawback is the increased maintenance and energy costs.

For either option outlined above, the unit will be equipped with an economizer. The economizer will operate if cooling is required and it is relatively cool outdoors by increasing the outdoor air flow and reducing the amount of recirculated air so that the cool outdoor air can be used to cool the indoors (without consuming energy to operate the compressor, if Option 2 is selected.)

Typically, natatoriums which hold competitions at the college or professional level demand precise control of indoor temperature and humidity and would therefore be equipped with a compressorized unit, but municipal swimming facilities may not have such strict requirements, and an air-to-air unit might be an appropriate choice. However, the summer climate in Massachusetts is such that there is a high probability that there will be a period of extended hot and humid weather during which the indoor conditions will fall outside of the acceptable range.

We understood that the foremost complaints regarding the existing system are related to inadequate ventilation. The buildup of chloramines in the space during moderate to heavy use is obvious when one visits the building. This is typically caused by inadequate ventilation including both the introduction of an inadequate volume of outdoor air and poor air distribution. Given the current condition of the existing unit, we believe that both elements contribute to the problem but that the amount of outdoor air is the primary cause.

We recommend that an air-to-air type system be installed, and that the air distribution be revised so that air is delivered at the West wall (the long exterior wall.) The air would be directed at a downward angle towards the exterior wall so that a convection cell will be created to improve air distribution. This will also serve to supply dehumidified air to the windows and will help to minimize the condensation on the glass. While the condensation doesn't seem detrimental to the building components (there are no wooden components to the windows), it is an aesthetic nuisance. If so desired, additional ductwork can be installed along the north wall to mitigate condensation there as well.

We have drawn up an initial design, and it is attached hereto. This sketch is intended as a descriptive supplement and is not adequate for pricing purposes or construction purposes.
We await your response and look forward to further discussion.

Respectfully,

Brian Smith, PE

Principal