KOHLER&LEWIS ENGINEERING

Mechanical Engineering for the Northeast

Police Standards & Training Facility
Concord, NH

John Jordan, Architect
32,600 square feet

Our goals were to provide a ventilating system for the firing range which would provide a safe environment for instructors and trainees, and low operating costs.

A review of current standards and technical information concerning firing range air quality and ventilation yielded recommended range air velocities of 50-75 fpm. We chose 75 fpm at the firing line as our goal, which means a total supply air flow rate of 48,000 cfm for this 20 booth, 80 ft wide range. Other recommendations were to maintain the range at a slight negative pressure, and to filter the range exhaust air to meet regulations for airborne lead.

In our harsh New England climate the cost of heating this large amount of ventilation air through the winter is prohibitive. Two options for lowering this cost were investigated: re-circulation systems, and energy recovery systems. We chose energy recovery to eliminate any chance of re-circulating contaminated air back into the range.

The main components of the system we designed are: a large air-to-air heat exchanger on the roof, which recovers 75% of the energy from the room temperature exhaust air to preheat the incoming cold ventilation air; a perforated plenum wall (essentially a giant register) behind the firing line to distribute the ventilation air evenly across the range; an exhaust plenum behind the bullet trap to collect the contaminated air; a filter room to filter the exhaust air before the heat exchanger; and controls to maintain a negative pressure in the range as the exhaust filters load up.

The heat exchanger includes a hot water coil to heat the pre-warmed ventilation air to room temperature, (a cooling coil could have been included for summer use but was deemed inappropriate for the New England climate). The heat exchanger was designed so that the supply ventilation air stream on one side of the heat exchanger core is at a higher pressure than the exhaust air stream on the other side of the core. In this case any leaks would be from the supply ventilation side to the exhaust side, further preventing the chance of any contamination.

The plenum wall is made up of modular acoustic metal panels with staggered hole pattern selected to provide even air distribution.

The filter room consists of 3-stages of filtration utilizing 30% pre-filters, 80% high efficiency filters and HEPA final filters. We estimate that the pre-filters will have to be changed every 3 months, the high efficiency filters every year, and the HEPA filters every 3 years based on average range use of 1 million rounds per year.

The control system utilizes supply and exhaust airflow measuring stations, and a variable speed drive for the heat exchanger exhaust fans. The variable speed drive is required to maintain a constant exhaust air flow rate 10% greater than supply air flow rate as the filters load up, otherwise the exhaust flow rate would drop below the supply flow rate and the range would be at positive pressure. A control panel in the command booth provides a visual indication of system airflow rates, heat exchanger and filter performance, and range and command booth pressure.

The command booth has a totally independent heating, air conditioning and ventilation system from the range for further protection of the instructor.

Tactical Center Ventilation System:

The Tactical Center System is intended for indoor instruction of police procedures, some of which involve driving automobiles into this area. These vehicles will not normally be operating other than the time it takes to drive them into the building. A very well ventilated space is desirable to handle the occasional exhaust emissions from running vehicles along with miscellaneous emissions from vehicles as they cool down.

We chose to ventilate this space as prescribed be code for a public parking garage or repair garage. This high ventilation rate again directed us to select a heat exchanger to reduce ventilation air heating costs. The airflow rate of the ventilation system is continuously adjustable from approximately 15% of maximum flow up to the design maximum airflow rate via a variable speed drive for the heat exchanger fans. This allows the ventilation to be adjusted to the need; high ventilation when the vehicles are first brought in, lower ventilation after they have cooled down. A manual dial located on a control panel in the Tactical center provides speed adjustment. Significant energy and operating cost savings should result from this type of control.