1.0 INTRODUCTION

As part of the Commercial and Institutional Building Energy Plan (CIBEP) program, the Energy Solutions Centre (ESC) contracted Northern Climate Engineering Ltd. to perform an ASHRAE Level 3 Energy Audit of the Watson Lake Ambulance Station. An ASHRAE Level 3 Energy Audit involves a detailed energy analysis of the building, a list of recommended energy efficiency measures (EEMs), and a Life Cycle Cost Analysis (LCCA) of EEMs involving capital intensive modifications.

2.0 BUILDING DESCRIPTION

The Ambulance Station/Emergency Measures Organization building is located on 10th Street South in Watson Lake, Yukon. The original building was constructed in the 70's as a Tilden car rental office. The building was subsequently used as a NAPA automotive supply outlet before being renovated three years ago for the current occupants. The spaces include a 75 sq.m. Ambulance bay, 56 sq.m. office/bedroom/vestibule/common area, a 52 sq.m. training room, and a 30 sq.m. addition for mechanical spaces and washrooms. The total conditioned area is 213 sq.m.

The facility is manned by two to three people from 8:00 am to 5:00 pm, Monday thru Friday. Weekend callouts are typically handled by volunteers who are called at home to respond.

2.1 Building Construction

The construction of the facility is as follows:

Original 15m x 9m building

- Slab-on-grade with no perimeter insulation
- 2x6 walls with 2x3 strapping (no strapping at the overhead door wall), batt insulation, total insulation value RSI 4.9 (RSI 3.5 at O/H door wall)
- Wood truss roof with RSI 7.0 batt insulation in the cavity, and RSI 1.8 rigid insulation at the underside. Total insulation value RSI 8.8
- Glazing; a combination of fixed double-glazed units and triple-glazed units fixed and with opening windows
- Doors; metal clad insulated overhead doors with double-glazed panels

Training Room Addition; 6.4m x 9m building

- Slab-on-grade with perimeter insulation and 'bubble wrap' under slab
- 2x8 walls with 2x3 strapping, batt insulation, total insulation value RSI 6.3
- Wood truss roof with a combination of batt and blown-in insulation in the cavity. Total insulation value RSI 10.6
- Glazing; a combination of fixed double-glazed units and one opening windows

Service Space Addition

- Floor system; 2x10 floor joists on 2x10 sill plate on gravel base, batt insulation in cavity. Total insulation value RSI 6.1
- 2x6 walls, batt insulation in cavity, total insulation value RSI 3.5
- Wood truss roof with a combination of batt and blown-in insulation in the cavity. Total insulation value RSI 8.6

2.2 Mechanical Systems

The facility is heated with an oil-fired low pressure Olsen boiler. The heat is distributed with twinned Taco circulators using residential style baseboard finned elements throughout the building with the exception of the ambulance bays and the entrance vestibule. The bays are equipped with unit heaters, and the entrance vestibule is heated with a cabinet unit heater. A small plate heat exchanger provides heat for the domestic hot water system during the heating season when the boiler is operating. During warm weather shutdown of the boiler, the electric side of the hot water tank is energized.

A heat recovery ventilator (HRV), located above the bedroom, provides fresh air to the offices, bedroom, and Training Room, exhausting from the bedroom and the corridor/common area. Each of the two washrooms is equipped with a ceiling mounted exhaust fan controlled by a wall switch in the room adjacent to the Training Room, and by a reset timer in the washroom beside the Ambulance Bay. In the Ambulance Bay, there is no provision for exhaust or make-up air.
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Potable water is delivered to the building and stored in a polyethylene tank located in a dedicated room in the addition at the south side of the building. A jet pump and pressure tank are located adjacent to the tank. The washroom accessed through the Ambulance Bay contains a water closet, lavatory, shower, laundry tub, and a combination washer/dryer unit. The washroom adjacent to the Training Room is fitted with a water closet and lavatory. The Training Room has a sink.

2.3 Electrical Systems

The building electrical systems are straightforward. Each of the office areas has personal computers (PC) and printers. The Training Room is equipped with a full size refrigerator and a bar size unit. A TV and PC are in this room as well. The Ambulance Bay is not fitted with any special equipment.

Lighting for the majority of the building is provided with 1200mm long fluorescent fixtures, either two or four 32 watt energy saving tubes. The washrooms have incandescent lamp fixtures.

3.0 ENERGY USE

The data below relating to the annual energy input was taken from the StartPoint Energy Audit provided by ESC. The energy consumption is based on the energy modeling using Hot2000 and hand calculations for DHW use and ventilation loads.

Energy Input

- Electricity; 17,528 kWh
- Fuel Oil; 50,000 kWh

- Total 67,528 kWh

Energy Consumption

Component	Consumption	% of total
Transmissive Heat Losses		
• Foundation	13,500	20
• Walls	11,900	18
• Windows and glass doors	10,200	15
• Doors	6,000	9
• Roof	4,600	7
Air Leakage	4,300	7
Summer Electrical Use	2,500	4
Domestic Hot Water	1,500	2
Washroom Exhaust	1,000	2
Chimney Losses	9,000	14
Outdoor Electrical Use	1,500	2
Total	66,000	100

4.0 COMMENTS

4.1 Spatial Review

The layout of the facility was reviewed with the supervisor with a view towards the efficiency of the space. Given the relatively small size of the building, the options for reducing energy consumption are limited. Introducing cooler storage areas was considered but is not feasible due to space constraints...

4.2 Building Construction

The building is generally well insulated, with the exception of the slab perimeter in the original building and the double glazed windows on the north wall. Given the exterior concrete paving at the front and at the rear of the building, it would be onerous to add insulation in these locations. There is a large section of perimeter on the east side that could be easily insulated due to the gravel landscaping. The foundation of the addition housing the washrooms, Mechanical Room, and the water tank, is not suitable for the intended purpose. The floor joists are supported on a flat 2x10 sill plate that rests on a gravel pad. There are gaps under the sill plate, perhaps resulting from rodents occupying the space below the floor system. Consideration should be given to reworking the foundation with a concrete or PWF support wall rather than the sill plate.

The wall at the overhead doors is an insulated 2x6 wall; no insulated 2x3 strapping installed as occurs in the other walls. Given that the majority of the wall area is replaced with overhead doors, there would be little advantage in applying additional insulation to the wall area.

The glazing in the building is a mixture of double glazed and triple glazed units. One of the opening windows on the east wall at the supervisor’s office will not shut due to an antenna wire that is routed through the opening. The wire should be routed separately. The double glazed windows on the north side of the building should be fitted with a storm glazing to reduce heat losses.

The weather-stripping at the glass entrance door and the Eastman door is in poor condition. It is recommended to replace it accordingly and to provide threshold weather-stripping as well. The seal surrounding both overhead doors appears to be satisfactory.

4.3 Mechanical Systems

The boiler is approximately three years old. The test data recorded on-site noted that the boiler efficiency was 86% at the date of the installation. During the site review, the Mechanical Room was observed to be very warm which was odd given that the boiler was off on warm weather shutdown. One of the heating system pumps was operating as was the domestic hot water circulator. It is suspected that heat from the hot water tank is back feeding through the heat exchanger and is being distributed to the building through the heating piping. This may result in overheating in the Ambulance Bay given that the space thermostat controls the unit heater fan operation, rather than a zone valve at the unit piping. This 'wild loop' will result in some rejected heat off the unit heater coils.

It was observed during the site review that the majority of the dampers in the baseboard cabinets were in the closed position. Since the heat output of the radiation is dependent on the chimney effect of the cabinet, the heating in the various zones has been compromised. In addition, the thermostat in the Training Room is located above and adjacent to refrigerators. As such, the thermostat will be fooled by the heat rejected from the appliances and will not control the general temperature of the space. The staff commented that the building could not maintain temperature set point during cold weather. With the dampers adjusted for maximum opening, set point should be maintained. (The boiler capacity is three times the calculated heat loss.)

The staff was not using the HRV for ventilation at the time of the site visit. This was due to a lack of understanding of the equipment and controls. It would be prudent to provide an instruction manual for the staff.

4.4 Electrical Systems

As noted previously, the electrical systems are straightforward and generally do not present opportunities for energy conservation. However, it is important to note that the electricity consumption is contributing to the heating load through the 'back feeding' mentioned above and through the operation of the ambulance motor heaters and battery blankets. It was observed during the site review that both ambulances were 'plugged in'. Consideration should be given to using an outdoor thermostat to control the heaters.