YUKON INN ENERGY STUDY

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PART I. Introduction

The Yukon Inn is in the heart of Whitehorse just north of the downtown area on Fourth Avenue. It includes the hotel with 95 guest rooms, 5 meeting and convention rooms of various sizes, the Moose Restaurant, the Sportsman's Lounge and the Boiler Room Bar. The legal description of the Yukon Inn site is Lots 1 and 2, Block 125, Whitehorse, Yukon.

The Yukon Inn is a two level structure that was built in four parts. In general, the hotel portion of the complex is an L-shape with approximately half the guest rooms, and access to the restaurant & lounge wing in the "old wing" perpendicular to Fourth Avenue. This wing was the original Tourist Services Hotel, along with the lounge and bar, constructed in the 1960's and is the most dated area of the building. This wing will hereafter be referred to as the Old Wing, and the Moose Restaurant, Sportsman's Lounge & Boiler Room Bar will be referenced as the Kitchen Wing. An addition in 1988 added a new lobby, guest laundry, main laundry, administrative offices and 40 guest rooms in a two story addition. This section is hereafter referred to as the Lobby Wing. The fourth part was built soon after the Lobby Wing and consists of a meeting room and mechanical room on the first level, and a residence on the second level, called the Conference Wing. The Moose Restaurant was the most recent part to be constructed but is included in the analysis for the Kitchen Wing as it is adjoining the lounge.

The building was initially viewed on November 22, 2001 with the assistance of the Manager and the head Maintenance Engineer, and a report ensued elaborating on the following sections:

i Structural integrity of old section and new section, including roof surfaces with a specific look at the settling indicators at the place where the two sections join.
ii An assessment of the nature of sound insulation between rooms in both sections, and also between floors.
iii A review of the primary mechanical/electrical systems to identify any potential major expenditure requirements that could arise in the next five years.
iv Identification of any obvious fire/safety code violations
v An indication of the order of magnitude cost of remediation of any problems identified.

These five sections are mainly included in PART VII of this report for information purposes. The remainder of this report focuses on methods for optimizing the energy use of the building components and summarizes the Yukon Inn's present day energy use and building condition. The on-site energy survey was done on February 8, 2002 with a follow-up visit on March 17, 2002.

PART II. Existing Conditions

Electricity is used for the standard loads of lighting and appliances as well as for baseboard heat in the Lobby Wing. Fuel oil is used for the boilers of the Old Wing and Kitchen Wing which supply heat for service hot water and for the hot water radiant baseboards for space heat in these wings. The hallway pressurization unit in the Old Wing is designed to have its fresh air tempered with a hot water coil also supplied by the boilers in the Old Wing. The Conference Wing is heated with a propane fired furnace.

The following table summarizes the Yukon Inn's yearly fuel and utility costs (based on 2001):

Utility		Cost
Electricity		$112,103.36
Fuel Oil		$ 33,943.72
Propane		$ 54,974.37
	Subtotal	$201,021.45
Water		$ 28,095.90
	Total	$229,117.35

These costs are representative of the facility as it is running presently. However, they are not representative of the facility with all of the mechanical systems functioning. Two glaring examples are the hallway pressurization unit for the Old Wing, which is running without bringing in outside air since the coil is not providing adequate heat to temper the outside air, and the air handling unit in the crawlspace of the Lobby Wing which is not functioning at all. If these systems were running, higher energy costs would be realized.

PART III. Envelope Options

Through infrared imaging it became evident that infiltration and poor insulation are contributing to high energy costs for the facility. A blower door test was conducted on rooms 141 and 143 combined, and an infiltration rate of 6.5 L/s per m^2 was determined. Details of the infrared imaging are found in PART IX.1 and details of the blower door test are found in PART IX.2. It is assumed that the remainder of the building has a similar infiltration rate. It has been reported that numerous locations have had sprinkler pipe breaks in the past, due primarily to the lack of adequate insulation. An exterior insulation retrofit of walls, roof and foundation is recommended for the Yukon Inn.

1. Foundation – crawlspaces & basements

Major losses occur in below-grade, partially insulated and uninsulated foundations, basements and crawlspaces alike. The crawlspaces are decently sized and relatively clean. The older areas have a concrete skim coat while the newer ones are gravel with a partial polyethylene cover (which is serving no practical purpose at this time). The Lobby Wing is built on a pressure-treated wood foundation wall, which is insulated and air/vapour sealed with polyethylene. The polyethylene has since fallen away in many locations or been removed for various reasons and is no longer effective. The entire crawlspace perimeter, including the Old Wing, requires proper insulation and air/vapour sealing to reduce heat loss in this area. In addition to adding insulation to the crawlspace walls and 1.2 m around the perimeter of the crawlspace floor, controlling temperatures to a maximum of 15 ^{0}C will be beneficial.

A. Crawlspace Walls

Crawlspace walls should receive at least two inches of Dow SM extruded polystyrene insulation to cover the outside area beginning at a point 102 mm above the wood-framed above-grade rim joist and extending downward to the top of the foundation wall footer. Metal flashing should be installed to prevent insect, ultraviolet light and water damage. The flashing should cover all exposed above-ground insulation and extend a minimum of 0.3 m below surrounding soils. This will require exterior excavation in order to access the area defined above. After attaching rigid foam to the crawlspace walls, the backfilled soil will hold the insulation tightly in place against the crawlspace walls. Metal flashing can then be caulked to the existing siding and screwed into place. If desired, a 25mm x 76mm (1" x 3") wood batten may be used to cover the flashing-to-siding joint.

B. Crawlspace Floor

Install a minimum of 50 mm of Dow SM rigid insulation so as to cover the perimeter of the crawlspace floor. This application should extend 1.2 m to the inside of the crawlspace wall/footer and be placed above a previously installed and sealed polyethylene air/vapour barrier. The vapour barrier should be a minimum of 6 Mil polyethylene and all edges, laps and joints should be air-sealed using a generous and continuous bead of TREMCO Acoustical Sealant and then mechanically fastened using staples, treated wood battens or 3M 8088 Red Contractors Tape. Maintenance traffic areas should be protected by a covering or plywood, used carpet (installed upside down) or other similar material that will inhibit puncturing and deterioration of vapour barrier material.

Basement walls should receive similar treatment to the crawlspace walls except for the common wall between basement and crawlspace. If the owner chooses to not fully excavate the basement walls, insulation should be applied so as to extend 1.2 m below grade. Little can be done to economically improve basement floor heat loss.

2. Above grade walls

Much of the wall area for this building is of 38 mm x 89 mm (2"x4") construction with later construction being of 38 mm x 140 mm (2"x6") framing. Exterior finish on the Old Wing is stucco while the new Lobby Wing is Ranch-Wall, or grooved exterior grade plywood, which acts as both the sheathing and the siding. Due to common construction practices for the era of construction, the 38 mm x 140 mm (2"x6") walls suffer from poorly installed insulation. All exterior above-grade walls should receive additional insulation as the existing installed insulation is deficient in many locations and below acceptable R-values for the Whitehorse climate. As interior surfaces are in good condition, the application of an exterior retrofit is recommended. Working on the building exterior will also allow for minimal disruption to the business operation.

Working from the outside, the walls should first receive a continuous application of an air-tight air/vapour barrier consisting of 6 Mil polyethylene. The air/vapour barrier must be installed in a continuous sheet as much as is practically possible, and securely sealed around all windows, doors, mechanical and electrical penetrations. To accomplish this will require following the same principles identified in the crawlspace floor description using Tremco, staples, tape, etc. Additional details may be provided if necessary.

Before continuing with wall insulation, the roof retrofit should be in place. It should have bottom cords sized to support a curtain wall that covers the entire wall area from the top of the crawlspace insulation retrofit to the second floor roof. The lower portion of this curtain wall may rest upon a simple ledger located near the first floor rim joist. See the roof section in PART III.3 below for more detail.

Following the roof retrofit the wall framing can be constructed. Tying the curtain wall to the roof bottom cords and supporting the lower portion on a shelf designed to handle the siding and insulation weight will allow simple insulating and siding installation. Several design approaches are available for such a 'curtain wall' and further information may be provided. How the wall framing is to be supported is important. All framing can be on 610 mm (24") centers as the only structural concern is for it to support light weight materials such as insulation and siding.

The RSI-value of insulation placed outside the new exterior air/vapour barrier should be two times that inside the existing wall. This is known as the "one third – two thirds rule" where placement of the air/vapour barrier must not penetrate into the composite RSI-value greater than one third of the way. Such a design will protect the wall against damaging condensation formation on the interior of the existing walls. Although this 'rule' is deemed to be very important in residential construction, a hotel typically receives less moisture input as the majority of clientele is not permanent. This renders a lower importance to such a rule, however, to guard against building failure I must urge such a rule be followed. Applying this would result in the

need for using insulation with a minimum value of RSI-3.7 over the 38mm x 89mm (2"x4") (RSI-1.9) walls and a minimum of RSI-5.3 over the 38mm x 140mm (2"x6") (RSI-3.3) walls. Even though the RSI-3.3 walls are identified as such, the poor quality of installation discovered in the infrared analysis of PART IX.1 shows them to be at RSI-2.6 or less for the installed condition.

After dimensional selection and application of wall framing the insulation may be installed. Such insulation may consist of several options including fibreglass batts, blown cellulose/fibreglass (BIB), rigid foam boards to spray-in-place foams. Dimensional thickness and insulation RSI-value per mm should be decided upon prior to framing of the curtain wall.

Of note is that some siding damage is present at the North East corner of the Lobby Wing guest rooms from what appears to be a vehicle over-running the parking curb. Repair would require replacing a couple of sheets of the exterior siding material, which would be done at the same time as the above exterior retrofit.

3. Roof

All roof areas of the building, including all three major areas (Old Wing; Lobby Wing and Conference Wing) are flat roofs with a tar and gravel roof system. The roof areas were all constructed with approximately the same process and technology, despite the number of years separating the construction. A built-up tar and gravel roof is the least expensive flat roof system to install but has a high failure rate due to the extremes in temperature. The tar shrinks and cracks in the cold, snow and ice build up in these cracks over the winter and then migrate into the roof structure in the spring or mild spells in the winter. In the summer the tar becomes very liquid, which reseals the cracks, but also "swallows" the gravel which allows more water to penetrate the edges of the gravel as time goes by. The water which leaks into this building is caused by poor quality and inadequately sealed and sized, roof flashings.

The current flat roof is poorly air-sealed and insulated as it was constructed with minimal insulation inside the roof cavity and minimal ventilation to remove any heat which builds up. It is recommended that the entire roof area be upgraded with a new roof system, including a substantial increase in insulation and ventilation. There are two types of upgraded roof structure to consider:

A. New Pitched Roof

Option number one, and the most economical roof retrofit, is a pitched roof, consisting of new roof trusses installed over the existing roof and at least a 3 in 12 pitched slope. As the existing flat roof is structural, the use of simple rafters in lieu of trusses may offer substantial savings in framing. The trusses or rafters are sheathed with plywood and either a sheet metal or asphalt shingle finish. Asphalt shingle roofs are the optimum choice for durability and ease of maintenance. As well, snow does not avalanche off, material does not expand and contract with the hot cold cycles, repairs are relatively easy to make and the initial capital cost is low. Presently, three exterior exits have shed roofs, which can dump ice or snow directly on exiting persons, however it appears that all exits are kept well cleared of snow and ice.

Sheet metal finished roofs are often considered to be the lowest cost, however experience has shown that this is not the case except in the most simplest of roof shapes. Metal roofs will allow snow to avalanche off which could cause serious injury or death to a pedestrian hit with the avalanche and often results in damage to cars parked beside the building. The material expands and contracts with the exterior temperature changes and after 10 years the screws make oblong holes in the material resulting in roof leaks.

Bottom chords of the roof truss must be sized to support curtain wall framing and the weight of associated siding and insulation to the ground level. Covering the exterior walls in such a manner will enhance energy efficiency and increase interior comfort for the occupants. Sealing the wall air/vapour barrier to the top side of the existing roof membrane will provide for minimal to no air leaks and only minimal diffusion of water vapour to the structural components of the building, in turn extending the life of the building.

Additional insulation may be placed upon the existing flat roof surface after the perimeter area of the insulated portion has been dense-packed using blown cellulose insulation. An area at least 0.6 m in width around the entire roof exterior rim is the focus for this recommendation. As the existing roof cavity is not completely full of insulation it allows free flow of outside air above the insulation. Only by fully filling the perimeter roof band area may we capture the R-value of the partially installed insulation with the air space above. Additional insulation may then be placed upon the old flat roof surface with a positive result. Should this insulation be placed without dense-packing the exterior band, it would essentially be floating above the first R-value and contribute little to increased thermal performance. Such an approach to flat roof retrofits has been successfully used in Alaska buildings for many years.

B. Flat Roof Upgrade

Option number two is to upgrade the existing roof with exterior rigid insulation, protection board and a two ply roof membrane that is torch applied. This is a very good roof system that provides high quality insulation levels. Repairs and upgrades are easily made to this type of roof system, and the durability matches that of asphalt shingle. However, there is a very high cost associated with this flat roof upgrade.

Under either option, all flashings, chimneys and vents are to be properly installed and sealed so that the entire roof structure is sealed water and weather tight.

4. Windows and doors

Windows in both wings are vinyl frame, double pane units with a combination of opening section sizes. These windows are contributing to the infiltration as seen in the infrared analysis of PART IX.1. The heat loss through the windows themselves is also fairly significant and can be greatly reduced with replacement. It is recommended to install triple pane, low-emissivity (e=0.1), vinyl framed windows with 12.7 mm of argon filled space between the panes. This will lower the U-value of the windows from approximately 3.19 to 1.57, where the lower the U-value, the less heat loss occurs through the window. The replacements may be combinations of opening and fixed like the present windows.

Exterior doors vary from insulated metal, to storefront aluminium with a few solid core wood ones on the exterior exit stairs. Most units appear to be in good overall condition.

5. Financial return

A model was created using EE4 for the Old Wing to evaluate the economic return of implementing the above retrofit. Details of this model are found in PART IX.3 and the results indicate that for the Old Wing alone a decrease of 52% of the energy costs could be achieved by reducing the infiltration rate from the existing 6.5 L/s per m^2 to 0.25 L/s per m^2.

Based on a blower door test of rooms 141 and 143 combined, infiltration rate of 6.5 L/s per m^2:

Yukon Inn - Old Wing as is - DOE

Calculation	Electricity	Other	Propane	Oil	Total	Energy Cost
Non-Compliance	286 179	0	0	6 189 916	6 476 095	$ 89 361

* Values listed are in MJ

Infiltration reduced to 0.25 L/s per m^2 by implementing exterior retrofit and window change-out:

Yukon Inn - Old Wing retrofit - DOE

Calculation	Electricity	Other	Propane	Oil	Total	Energy Cost
Non-Compliance	279 769	0	0	2 575 835	2 855 604	$ 42 413

* Values listed are in MJ

In the Old Wing, 18% of the total output of the boilers appears to be directed to service water heating, the remaining 82% to space heat. Assuming this to be consistent throughout the building and that 5% of the total energy cost is associated with electrical loads other than heating, the result would be a savings of $82,700 per year (52.5% of $157,500), based on 2001 energy use.

Total building envelope retrofit savings per year = $82,700

PART IV. Mechanical Options

1. Heating systems

There are two boiler rooms in the facility, one in the Kitchen Wing and one in the Old Wing. The boiler room in the Kitchen Wing has old 3 modular boilers with a total of 8 burner sections. The room has numerous heat exchangers and re-heat coils, which direct the heat to make up air units and domestic hot water units. There are minimal controls on the system and no interconnection to the newer boilers in the second mechanical room in the Old Wing. It appears that most of the equipment in the Kitchen Wing boiler room serves the Kitchen Wing which includes the Kitchen, Restaurant, lounge and tavern as well as heat for the Old Wing units. The boiler room in the Old Wing has three relatively new boilers, which appear to be dedicated to production of domestic hot water and provision of hot water to the hallway pressurization unit and the various re-heat coils, which provide tempered ventilation air to the conference rooms.

A. Kitchen Wing

The Kitchen Wing has three 1972 Hydrotherm boilers:

1 each CSY-1017 with 3 each Riello Model 5M burners
1 each CSW-1154 with 2 each Riello Model 10M burners
1 each CSZ-1102 with 3 each Riello Model 10M burners

These boilers are cause for some concern as they are old and difficult to get to for maintenance. The Reillo burner on #8 boiler was found to be very loose and dangerous, the damper is not functioning properly, and based on their oil consumption, the efficiency is very low. It is recommended that these be replaced with high efficiency boilers once the exterior retrofit is done and the new heating load is determined. Should the exterior retrofit be performed on the building, shell reductions in heating capacity will be necessary. The potential for downsizing the heating systems should be considered before investing in upgrades of the existing units or controls. Removal of some heating capacity will be possible and by step firing the remaining units, significant savings to the business operating costs will be realized.

B. Lobby Wing

The Lobby and Conference Wings are the only ones that are not heated by a hot water radiant system. The Lobby Wing has electric baseboard heat throughout, and the Conference Wing is heated by the propane furnace. The replacement of all the electric baseboard heating units with hot water radiant units has the potential of great savings in electrical costs for the Lobby Wing. The hot water piping has been brought from the Kitchen Wing to the Lobby Wing to feed the air handling unit there, so the only additional piping required for this conversion is distribution piping to each room.

The emergency exit stairway for the second level of the Lobby Wing is heated by a Chromalox electric heating unit. This unit was added to help eliminate the multiple sprinkler pipe freeze-ups that were occurring in the area. The stairway is maintained at an uncomfortably high temperature, 34°C at the time of the survey, and the doorway is not always closed properly. This is an unnecessary load that could be reduced by replacing the unit with a hot water radiator and maintaining the minimum temperature necessary.

The following model simulates changing the existing oil boilers and hot water radiant heating system into electric resistance heat for the Old Wing. The results are a significantly higher energy cost, which is what is being experienced in the Lobby Wing. The dollar values are calculated using $0.1045 per kWh for electricity and $0.50 per litre for fuel oil.

Yukon Inn - Old Wing as is - DOE

Calculation	Electricity	Other	Propane	Oil	Total	Energy Cost
Non-Compliance	286 179	0	0	6 189 916	6 476 095	$ 89 351

*Values listed are in MJ

Yukon Inn - Old Wing electric heat - DOE

Calculation	Electricity	Other	Propane	Oil	Total	Energy Cost
Non-Compliance	5 342 147	0	0	0	5 342 147	$ 170 379

*Values listed are in MJ

If an increase of 90.6% in energy expenses is achieved by switching to electric heat, as seen by this model, then it can be estimated that an equal decrease in energy expenses can be achieved in the Lobby Wing by switching to a hot water radiant system powered by oil boilers. The average room in the Lobby Wing has a 1.75 kW electric baseboard heater, with 50 rooms this equates to a maximum load of 87.50 kW. To run this load 12 hrs. of the day from September to the end of April costs approximately $26,300 (2880 hrs. x 87.50 kW x 0.1045 ¢/kWh). With the recommended fuel switch for the Lobby Wing, the annual savings would be in the order of $12,500 per year, or reduce the heating load to $13,800 from $26,300.

C. Heat Pump

There are a couple of ways a heat pump could be used. The evaluation in PART IX.4.C done by RETScreen shows that a ground source heat pump has a payback of 24 years. This is recommended as a heating alternative to oil once the cost of oil rises above $0.79 per litre, bringing the payback down under the 10 year level. Another option is to install heat pumps in series with the existing oil boilers. This system allows the boilers to provide the source heat to the heat pumps, which in turn feeds the hydronic system that exists presently. It is recommended that this option be pursued once the exterior retrofit is done and the new heating load is determined.

2. Ventilation systems

A. Old Wing

The Old Wing's hallway pressurization unit has the fresh air intake closed and is getting make-up air from the room in which it is located. This is possibly due to a mal-functioning heating coil through the unit, which allows cold ventilation air to flow without being heated, and likely resulted in someone shutting the cold air intake. Upon closer inspection, it was noted that there is little to no hot water flow through the heating coil, and the pumps in the basement boiler room are vibrating and possibly cavitating. A review of the maintenance records with respect to these pumps would be helpful in confirming this. The hot water supply to these pumps is inadequate and is the target for repairing this system. The repair of this system will save costs in pump repair, extend the life of the pumps and provide for a far healthier environment, but will not save in energy costs.

Also, there is no mixing valve on the heat exchanger to modulate heat on the hallway pressurization unit and no automatic control valve. This severely limits the ability to control the unit and the temperature at which the supply air is delivered. See also the comments under PART VI and PART VII.2.A with respect to this unit.

B. Kitchen Wing

There in one exhaust fan of unknown capacity and power consumption in the Sports Page Lounge. Removal of this single exhaust fan is recommended with the installation of a heat recovery ventilator in its place. A ventilator such as the Lifebreath 1200 DD will improve air quality and reduce heating costs. Ducting the exhaust from the room so as to extract air from over the smoking area and supplying fresh air to the opposite side of the room will serve to reduce complaints from non-smokers. This would require minimal ducting in order to supply to the raised floor area and exhaust over the bar. More details may be supplied if desired.

C. Lobby Wing

The Lobby Wing's hallway pressurization unit is located in the crawlspace and is very difficult to access. It does not appear to have functioned in a long time. This unit must be repaired to ensure high-quality air in this wing.

The intakes for the air handling units are outside the back wall at ground level, facing a neighbouring parking lot. It is recommended that these be taken up higher to fresher air.

D. Solar Air Heating

Solar air heating is not yet common in Whitehorse, however the model found in PART IX.4.B indicates an excellent return for this kind of system. The payback for a solar wall on the south side of the building which would heat the ventilation air before it enters the building is 3.4 years if the REDI incentive is taken into consideration. See PART VIII.3.A for additional information on this incentive. It is recommended that a solar air heating system be installed at the same time as the exterior retrofit so that no additional labour costs are incurred. This installation will have an equipment and installation cost in the order of $30,300 less 40% from the REDI incentive resulting in a final cost of $18,200. The yearly savings in energy are estimated to be $9,200.

3. Service water

There are three ways of decreasing the cost of service water. The first is by reducing consumption, the second is by reducing the hot water load, and the third is by providing a less costly means of heating the water.

A. Consumption

Presently low-flow Teledyne Waterpik Supersaver showerheads are used in the showers. This is extremely beneficial in reducing hot water loads. In addition to these, consumption reduction would be achieved with low-flow faucets in the sinks and low-flush toilets.

The low-flush toilets are mandated by a City of Whitehorse Bylaw, however this facility was constructed prior to the bylaw implementation so conformance is voluntary in the existing building. Low-flush toilets are recommended in a hotel if they are adequately pressured in order to avoid increased maintenance calls to unplug the toilets from the reduced water volume. The higher pressure-low flush toilets are preferable and have proven successful in many facilities. Replacing an 18 litre-per-flush toilet with an ultra-low-volume (ULV) 6 litre flush model represents a 70 percent savings in water flushed and will cut indoor water use by about 30 percent. (Source: Environment Canada "The Management of Water")

Conventional faucets have an average flow rate of 13.5 litres of water per minute. Installing low flow aerators will reduce this flow. In the bathroom, a flow rate of 2 litres per minute is adequate, and in the kitchen a flow rate of 6 to 9 litres per minute is sufficient. It is unnecessary to retrofit the faucets in the baths, the volume of water delivered to a bath does not change, it will just take longer to fill with low-flow taps and inconvenience the user. (Source: Environment Canada "The Management of Water")

If 30 percent of water use is achieved by implementing the toilet and tap retrofits, the equivalent water cost savings is $8,400 per year.

B. Load

Installing insulation onto all exposed domestic water and heating piping is recommended. The low cost of insulation is far outweighed by the savings that are achieved. Should crawlspace temperatures be reduced to lower levels than desired, the installation of a separate crawlspace heating zone is recommended.

C. Solar hot water

Solar energy is an excellent way to heat service hot water. The model details are found in PART IX.4.A and indicate that the Whitehorse climate and solar exposure are adequate for solar hot water using a glazed system. The payback for this type of installation is in the order of 14 years if the REDI incentive is taken into consideration. See PART VIII.3.A for additional information on this incentive. The paybacks for an unglazed or evacuated system are over 25 and 23 years respectively. It is recommended that a glazed solar hot water system be reviewed and installed only if the cost of oil rises above $0.62 per litre, rendering the payback period below the 10 year mark.

4. Control

Several large areas of the building were operating at excessively high temperatures during the survey; the crawlspace, the second floor stairwell and the Boiler Room Bar. Improving control of such areas will greatly reduce energy use by lowering the temperature difference across the envelope.

A. Ventilation control

The Old Wing's hallway pressurization unit appears to be running non-stop. Once the repairs of PART IV.2 are implemented, this unit may be timed based on occupant loads.

The Kitchen Wing has a manually controlled air handling unit although there is a time clock present. Automatic control of this unit is recommended.

The Conference Wing's air handling unit has an "occupied/unoccupied" switch. During the audit tour it was noted that although the meeting room was unoccupied, the switch was left on "occupied". This has the effect of introducing fresh air into the room that is heated by the propane burner. When the switch is turned to "unoccupied", the fresh air intake damper is closed, and air is recirculated so heating load is greatly reduced. It is recommended to either link the switch with the lights so that when the lights are off, the air handling unit runs in "unoccupied" mode, or to have the switch by the door so that the last person in the room is reminded to switch it to "unoccupied".

B. Boiler control

The Old Wing's boilers have a Tekmar 2 stage control that is set by a local heating contractor Duncan's Ltd. Even with this controller, the 3 boilers are manually alternated at the first of the month, so that they share the role of lead boiler. Not all of the Old Wing's boilers service the same system, some are for service water heating and some are for space heating, so it is recommended that control of these boilers be reviewed and automated according to their purpose.

5. Mechanical equipment

It was reported that the washing machines in the Lobby Wing need to be replaced due to continual mechanical failure.

6. Financial return

The energy savings achieved by implementing the above recommendations are as follows:

Replacing electric baseboard heat with a hydronic radiant system = $12,500 per year.
Installing solar air heating = $9,200 per year.
Installing low-flow faucets and toilets = $8,400 per year.

Total building mechanical retrofit savings per year = $30,100.

PART V. Electrical Options

The facility is served with underground power from a pad mounted transformer located to the rear of the building, to a main electrical room located in the basement areas of the Kitchen Wing. The service has been sized to accommodate all the present facility and was upgraded in 1988 when the additional rooms and facilities were added. There is distribution to various sub panels located in the public corridors of each floor.

Communication facilities are adequate with phones provided through a central switchboard, which is typical of hotel properties. In-room guest computer facilities are limited and might be considered for upgrading as a matter of guest convenience.

1. Lighting

Guest rooms and public areas appear to be adequately served with power and lighting. The lighting package may be somewhat dated, but illumination levels appear to be within normal ranges for a hotel facility. Time did not allow for adequate inventory to be collected on lighting in the entire building. Only the Sports Page Lounge and Boiler Room Bar received scrutiny with a general observation given to the rest of the hotel and restaurant.

A. Old Wing

The Old Wing's second level hallway lighting consists predominantly of efficient compact fluorescent lamps. The rooms, however, have not seen the same consideration. There are 7 to 8 incandescent lamps per room including 4 in the bathroom, which equates to approximately 700 bulbs that could be changed to compact fluorescent and save in electrical costs.

B. Kitchen Wing

Sports Page Lounge:
The lighting circuit in the lounge is presently loaded and unable to carry all light fixtures installed. Seventy-five watt floods are mostly in service.

4 each	60 watt fixtures over bar
20 each	75 watt floods on tracks
3 each	60 watt wall lamps
4 each	60 watt bulbs over pool and foosball tables

Installing dimmable compact florescent bulbs in all dimmable fixtures and common electronically ballasted bulbs into all non-dimmable fixtures is recommended. This will reduce fire danger and enable the lighting circuit to function properly without danger of overheating the circuit breaker.

Boiler Room Bar:

18 each	50 watt Par 20 incandescent
15 each	34 watt FW40CW single bulb fixtures (fluorescent)
3 each	60 watt incandescent bulbs at bar
1 each	80 watt FW40CW two bulb fixtures (fluorescent)
1 each	60 watt incandescent at stairwell entry

It is recommended to replace all 50 watt Par 20 bulbs with dimmable compact florescent bulbs. Replace all 34 watt FW40CW single bulb fixtures with electronically ballasted T-8 fixtures according to daily service hours. If hours of use are less than six hours leave existing units in place. Replace all incandescent bulbs with compact florescent bulbs as necessary.

C. Conference Wing

The Conference Wing also has 28 incandescent lamps and 22 2-lamp fluorescent lights. Using the same principle as above, where replacement is done primarily to fluorescent lights that are operating for more than six hours per day, will result in maximized savings.

2. Exit signs

Improvements to public lighting and exit signage should be undertaken immediately as payback will be rapid and savings excellent. Replace exit sign bulbs with LED units compatible with bulb holders. The new LED units use as little as 1 watt and have over a 25 year life. See also the comments in PART VII.2.E with respect to an exit sign in the Old Wing.

3. Financial return

For comparative purposes, the cost of incandescent lamps are in the range of $5.80 per million lumen hours whereas the cost of compact fluorescent lamps are $1.40 per million lumen hours, and the latter have a lamp life that is over 20 times that of the standard incandescent lamp. Using the model to calculate the savings in the Old Wing by implementing the above recommendations and extrapolating that to the whole building results in savings of 5% per year, or $10,100.

Yukon Inn - Old Wing as is - DOE

Calculation	Electricity	Other	Propane	Oil	Total	Energy Cost
Non-Compliance	286 179	0	0	6 189 916	6 476 095	$ 89 361

*Values listed are in MJ

Yukon Inn - Old Wing lighting replaced - DOE

Calculation	Electricity	Other	Propane	Oil	Total	Energy Cost
Non-Compliance	148 272	0	0	6 211 060	6 359 332	$ 84 764

*Values listed are in MJ

Replacement costs for all of the incandescent lighting and the T-12 fluorescent lighting would be as follows (all labour based on $50 per hour):

Old Wing and Lobby Wing: 760 incandescent lamps, estimate 4 exit signs.
$15 per compact fluorescent lamp plus labour at 0.5 hours per room = $13,800.
$79 per exit sign plus labour at 1 hour per sign = $500.

Kitchen Wing: 53 incandescent lamps, 16 (lounge & bar) + 14 (estimate kitchen & basement) four foot T-12 surface mounted fluorescent lamps, estimate 5 exit signs.
$15 per compact fluorescent lamp plus labour at $50 per hour and 0.25 hours per lamp = $1500.
$8 for two four foot tubes (fluorescent lamps) plus $35 per T-8 electronic ballast fixture plus labour at two hours per fixture = $4300.
$79 per exit sign plus labour at 1 hour per sign = $600.

Conference Wing: 28 incandescent lamps, 22 four foot T-12 surface mounted fluorescent lamps.
$15 per compact fluorescent lamp plus labour at 0.25 hours per lamp = $800.
$8 for two four foot tubes (fluorescent lamps) plus $35 per T-8 electronic ballast fixture plus labour at two hours per fixture = $3100.

Total building lighting retrofit = $24,600.
Savings per year = $10,100
Simple payback = **2.4** years.

PART VI. Maintenance

Due to several building styles and different eras of construction this building qualifies as having a complex HVAC system. The following recommendations are aimed at increasing maintenance effectiveness throughout the facility, thereby decreasing operating costs.

i All mechanical systems should be inventoried, their specific locations and affected building coverage areas noted on a floor plan schematic. All systems operational sequencing and controls should be listed and printed into a comprehensive building O&M Manual.

ii Make duplicate copies of the O&M manual and archive one set in the manager's office.

iii Develop a scheduled mechanical system maintenance routine.

iv Identify all areas with potential conflicts between heating and ventilation controls.

v Redesign access to the Lobby Wing air handling unit (in crawlspace).

PART VII. Important Observations

The following observations were made during the energy survey but are not related to energy consumption or efficiency. They are merely noted here for the Yukon Inn's reference.

1. Sound separation

Sound separation between the guest rooms and the corridor is minimal and reports from the manager and staff indicate that the suite to suite sound separation is also minimal. As each guest room is fully drywalled, including the ceiling, the poor sound separation must be due to lack of insulation and sound bar in the walls. This would have been fairly typical of rooms constructed in the 60's. The solution is to add material to the walls and ceilings of each room and the corridor side of all guest rooms to upgrade this sound resistance. An uninsulated drywall wall with 2x4 studs has an STC (Sound Transmission Co-Efficient) rating of 34. With the addition of Resilient Sound Bar and 5/8" gypsum board to each side of the wall, this rating is increased to 49. Adding Noise Stop Board to each side further increases the STC rating to 58 or virtually half the sound transmission of the present construction. This would be a highly superior sound resistance rating as the 50 to 54 level is the rating normally sought.

2. Fire control

A. Hallway pressurization

The hallway pressurization unit of the Old Wing needs to have the duct for the first level taken all the way to the hallway to avoid pressurizing the stairway, which is where it ends presently. Fire-rated doors are also needed to isolate the stairway in this area. There needs to be fire-rated shafts for the ducts that are taken to the second level and through the wall to the hallway in the Old Wing.

B. Sprinkler system

The facility has been upgraded with a wet pipe sprinkler system, which appears to cover all areas of the facility. Due to recent changes in the sprinkler/Fire Alarm codes it can be expected that the sprinkler system will require upgrades and modification to its reporting structure and the addition of flow switches to properly identify where in the building a sprinkler head has been set off. To ensure proper sprinkler design and installation and conformance to all current codes, a professional mechanical engineer must be hired to as-built the system and determine the level of upgrades required. If the system was properly designed and installed at the time of installation (approximately 1988) the remediation costs should be quite minor and limited to flow control and sprinkler tree signal devices.

A 6" water main is recommended rather than a 4" water main (seen in the metering room of the Old Wing) to ensure adequate flow to sprinklers should there be a break in the 2" line for the meter.

C. Alarms

The facility is provided with a central, single stage fire alarm system, consisting of a Mirtone 8000 fire Alarm panel. The most recent Fire Alarm Verification Report shows that the system is

fully functional with only minimal deficiencies noted. Any upgrade to the system should include converting the Old Wing to a fully compatible system. Due to recent experience and code changes in Fire Alarm systems, it can be expected that additional bells will be required to fully meet the audibility requirements of the code and that additional alarms will have to be installed in each guest room. These upgrades, along with those resulting from the sprinkler system will then result in the need of a new and larger fire alarm panel to accommodate the additional zones.

D. Floor-to-floor fire separation

The effect of the sprinkler system renovation on the fire protection of the wing is cause for some concern. The sprinkler addition was completed after the wing's construction (no record on file, but suspected to have been 1988 when the newer additions were added). To install the sprinkler piping, sections of the drywall ceilings were removed between joists to provide a cavity to install the piping. It is not known at this time if the cavity was protected on the top and sides with fire-rated drywall, however the underside (ceiling) has had peg-board installed to allow heat into the cavity to protect the piping from freezing. As peg-board is not fire-rated, and is full of holes, if the cavity was not constructed as a fire-rated chase, then the floor-to-floor fire separation rating is not being met. It was not possible to verify whether or not this is the case without causing damage to the existing finishes.

There are holes cut in the wall behind the dryers in the Lobby Wing to allow either venting or servicing, however these holes are through a required fire separation and do not contain fire dampers, so they are in violation of the building code. The dryers were not installed with rear service in mind but if such service access is required, fire-rated doors and frames should be installed in the corridor wall so that all fire separations are maintained intact. There is another opening in the wall between the laundry room and the baggage room as well as an open shaft between the laundry room and the linen closet, which both need to be properly fire-rated or eliminated. There is a fire-rated laundry chute immediately adjacent to the open shaft, so the reason for the open shaft is unclear. A fire-rated shaft for the chimney of the oil-fired hot water tank is also needed.

Other observations include: the Kitchen Wing needs a fire-rated shaft for the chimney of the oil-fired boilers, and fire extinguishers need to be updated.

E. Exit signs

There is an "Exit" from the second floor at approximately the middle of the wing, which leads from the second floor to the main floor corridor. This exit does not meet code from a number of aspects, including that there are no main floor exit lights, emergency lights or panic hardware on the doors. However, the exit location itself does not meet code as it empties out into the middle of the main floor corridor length, or into another fire compartment, which is not allowed. As this wing has two dedicated exit stairwells (one at either end) plus access to the main lobby, this internal exit is not required and should have the exit signs removed. It is acceptable to use as a means of access, but must not be labelled an "Exit". Emergency lighting is required in all stairwells however, and all doors in the public corridors must have panic hardware.

F. Fire and exit doors

The Lobby Wing main corridor to the guest rooms has had an unrated double door added, probably in an attempt to reduce sound transfer from the conference room to the guest rooms. The door does not meet code requirements, however, since there are no exit lights and there is improper emergency light spacing associated with the door. It is currently held open with a magnetic hold-open device and should the fire alarm signal an emergency, the magnet will release and this door will close. At that time, the door will impede exiting and may lead to guests becoming lost or trapped.

The doors in the other wings are also of concern. The magnetic hold-open devices for the doors in many locations of facility are loose and need repair. Metal doors and frames in fire separations have no ULC label and need to be replaced with ULC-rated doors, and none of the fire or exit doors have proper exiting hardware.

3. Water safety

A. Meters and boilers

Backflow valves should be present on all meters and boilers, although this is not yet required by code. The boiler room in the Old Wing has backflow valves on the cold water supply to the CB4A-9 and CB4A-7 boilers but not for the third smaller boiler CB2A-9. There are none present in the water meter room of this area.

B. Anti-scald showers

Plumbing systems in general appear quite adequate, with the only area obviously deficient being the lack of anti-scald devices on the showers.

4. Structure

The following observations were made in the initial summary report and are reproduced here for information purposes. A professional structural engineer was not engaged to review any portion of this facility. A basic structural review of the crawlspace and general building areas has not brought any structurally deficient areas to light, except possibly the main entrance canopy.

In the Lobby Wing laundry room the floor has a noticeable sag in the front half. There appeared to be no reason for this when the floor construction was investigated, except that the floor joists were installed at maximum span and maximum spacing and this room has a considerable load of traffic, higher than adjacent areas. It would be advisable to add an intermediate beam at mid span of this floor area to remove the sag and ensure that further problems are not created.

The scullery off the Fireside south conference room has a substantial difference in floor elevation and obvious signs of wall separation. Investigation of the foundation indicates that all footing and foundation wall components are sound and adequately constructed. It is doubtful that any foundation settling or structural damage has caused this floor issue. It is quite possible that the floor differential is strictly a matter of material shrinkage. This small area of the facility was added on after 1988, however no record can be found of the exact dates. The building ended in a masonry firewall and the conference rooms were added to the exterior side of that firewall. It is likely that the new floor was not constructed exactly level with the existing floor and then

material shrinkage increased the differential. The wall gaps with air and water leakage are again most likely caused by material shrinkage and inadequate roof flashings which are allowing weather into the facility.

The second floor joint to 1960's Old Wing on the second floor where the 1988 Lobby Wing attaches to it has a floor differential of approximately 50 mm. There is no indication of a floor problem on the main floor and no indication of a problem in the crawlspace; so once again, it is believed that this differential between the floors is due to material shrinkage. To prevent guests from tripping it may be necessary to install an oversized aluminium threshold at this door.

The second floor north corridor has a badly sagging suspended ceiling tile and grid system and it is in danger of collapse into the corridor. This ceiling should be removed immediately and re-constructed with new materials, properly anchored into the structure above.

While it was not possible to inspect the entrance canopy without causing damage to finishes, it was reported that the snow needs to be kept cleaned off and not allowed to build up a load or the canopy is in danger of collapse. If this is the case, the canopy should be evaluated immediately for structural integrity and upgraded as required. Due to the short time period allowed for this review, structural review of this area by a professional engineer has not been possible.

There can be no consideration of additional floors added to the facility without major structural upgrade as the foundation walls and internal support structure is only sized to be barely adequate for the present two floor structure.

PART VIII. Financial Summary

1. Recommendations

Recommendation	Install cost	Annual savings	Payback
Envelope exterior retrofit		$82,700	
Replace electric with hydronic oil		$12,500	
Install heat recovery ventilator in bar			
Solar air heating	$18,200	$9,200	3.4 years
Low-flow toilets and faucets		$8,400	
Insulate service water piping			
Install mechanical system controls			
Lighting retrofit	$24,600	$10,051	2.5 years

2. Budget

A review of the Schematic Design Drawings, the information contained in this report and previous experience in the design and construction administration of similar buildings, indicates that the following budget will provide for development meeting the requirements set forth by the Client group:

A. Estimated energy upgrade costs:

Exterior Retrofit:	$400,000.00
Crawlspace insulation/AVB Retrofit:	$ 25,000.00
Roof Retrofit - Trusses/shingles:	$200,000.00
Roof Retrofit - Membrane:	$300,000.00

B. Other renovation considerations:

Sprinkler Pipe Fire-Rated Cavities @ $1,500/room x 40:	$ 60,000.00
Emergency and Exit Light Revisions:	$ 20,000.00
Door Hardware Revisions:	$ 25,000.00
Sound Separation Upgrade @ $4,000/room x 95:	$ 380,000.00
Laundry Room Floor Upgrade:	$ 5,000.00
Laundry Room Fire Separation Upgrade:	$ 15,000.00
Scullery Floor Upgrade:	$ 5,000.00
Floor joint Old to Lobby Wings:	$ 1,000.00
Second Floor Corridor Ceiling:	$ 10,000.00
Entrance Canopy Upgrade (Structural Review):	$ 2,000.00
Sprinkler System Upgrades:	$ 25,000.00
Fire Alarm System Upgrades:	$ 25,000.00
Subtotal:	$ 573,000.00
Estimated cost for full retrofit w/shingle roof:	$ 625,000.00
Estimated fees for design, tender and Administration:	$ 120,000.00
Estimated renovation costs:	**$1,318,000.00**
As-built sprinkler system:	$ 8,000.00

3. Energy upgrade funding options

The recently formed Energy Solutions Centre, which is jointly funded by Yukon Energy Corporation and Yukon Development Corporation, is responsible for the delivery of a number of Federal and Territorial initiatives aimed at reducing the dependence on fossil fuels. The programs offered are well worth investigating and have been shown to provide payback within 3 to 7 years depending on the program considered and the level of upgrade undertaken. The following is a brief description of the programmes:

A. Renewable Energy Deployment Initiative (REDI)

This program is suitable for a solar domestic water heating system and a solar wall system. Contribution is 40% of actual costs of these systems, including design, installation and purchase, including their control systems, up to a maximum contribution of $80,000.00.

B. Innovators Program

Offered by NRCAN, is currently being modified to allow single building property owners to access this program (previously required a minimum of 4 properties to be completed). Funding levels are expected to be a percentage based on energy savings achieved to a cap of $225,000.00. Program covers general energy related upgrades, such as retrofits, windows, doors, heating systems and any related items which result in energy savings.

C. Power Sales Incentive Program, or Secondary Power Sales

This is the Yukon Energy Program which utilizes "surplus power". While this concept may be unusual to most localities, in the Yukon we generate our own hydro power, but are not connected to the main grid outside the territory, which eliminates the ability to sell off surplus power needs and provide for stable production. The utility has great difficulty in managing the power produced against the power demand and this program was seen as a means to equalize the power consumption, to the power production. The term "surplus power" refers to the times when the utility is producing more hydro power than it is selling. The program consists of the installation of an electric boiler, a separate electrical service and meter and a controls package. The boiler is turned on and off by Yukon Energy Corporation, when they determine that surplus power is available. This power is sold at a fixed rate of 3.3 cents per kilowatt hour based on the meter reading of the systems independent meter. This rate may change, as the rate is set at 10% less than the "avoided cost of diesel fuel oil". There are a number of rules for this program, and in typical Government fashion are presented in a varying number of "what-if" scenarios.

D. Commercial Energy Management Program (CEMP)

This program is a one time only grant of 10 cents per kilowatt hour projected to be saved through the upgrade to energy efficient lighting between October 31 and March 31 and 5 cents per kilowatt hour projected to be saved in the period of April 1 through September 30.

E. Energy Solutions Centre financing

The Energy Solutions Centre has also recently announced the ability to finance much of the equipment that would be used in an upgrade.

PART IX. Appendices

1. Infrared reports

A. Old Wing; Rooms 141 & 143 and Exterior

B. Kitchen & Conference Wings; Lounge, Restaurant and Banquet Room

C. Lobby Wing; Room 231

2. Blower door test results

Blower Door Test Data of Rooms 141 & 143 (Combined):

HP	FP	(All Ring B)
51.0	212	
46.8	189.5	
42.8	165.7	
36.6	139.6	
29.3	103.5	

Blower Door Test Results
767 cfm @ -50 pa
9.62 ACH @ 50 pa
1.28 cfm/sq. ft. floor area
77.1 sq. in. Canadian Equivalent Leakage Area @ -10 pa
Flow Coefficient (C) = 56.5
Exponent (n) = 0.667
Correlation Coefficient =.99914

3. EE4 Simulation

EE4 is a program developed by Natural Resources Canada for the Commercial Building Incentive Program (CBIP) which offers 40%. The CBIP simulations assume typical building use patterns and standards of construction. Because these patterns and standards vary from building to building, simulations may or may not be indicative of the building's actual energy consumption. The simulations do, however, provide a good basis for comparison of energy consumption before and after retrofits.

Yukon Inn Old Wing as is Loads

System/Zone	Heating	Sensible	Latent	Airflow
System - Area #1 HVAC	74.9	0.3	-11.3	1242
Zone - Zone 1-level1 N	17.9	9.2	0.5	1781
Zone - Zone 2-level1 S	17.9	17.3	0.5	1781
Zone - Zone 4-level2 N	17.4	7.5	0.4	867
Zone - Zone 5-level2 S	17.4	15.3	0.4	867

* Heating and Cooling values are in kW * Airflows are in L/s

SUMMARY COMPLIANCE REPORT

Part 1 of 2

PROJECT NAME: Yukon Inn Energy Audit	DATE: 24/06/2002
PROJECT ADDRESS: 4220 - 4th Ave Whitehorse	
COORDINATING PROFESSIONAL: Gordon Sinclair	TELEPHONE: 867-667-7205
DOCUMENTATION AUTHOR: Sandy Birrell-Swarthmoor Eng.	Building Permit # Checked by/Date Authority Having Jurisdiction

GENERAL INFORMATION

DATE OF PLANS	BUILDING CONDITIONED FLOOR AREA	BASIS FOR SPACE USE CLASSIFICATION
	2 606 sq.m	☐ Building Type ☒ Space Function
LOCATION: Whitehorse	ADMINISTRATIVE REGION: Yukon Region A	

STATEMENT OF COMPLIANCE

This Certificate of Compliance lists the Building features as per actual building permit drawings and specifications in accordance with Part 8 of the Model National Energy Code for Buildings.

DOCUMENTATION AUTHOR	SIGNATURE	DATE
Sandy Birrell-Swarthmoor Eng.		

The Coordinating Professional hereby certifies that the proposed building design represented in the construction documents and modelled for this permit application are consistent with all other forms and worksheets, specifications, and other calculations submitted with this permit application. The proposed building, as designed, meets the mandatory requirements of the Model National Energy Code for Buildings and the energy efficiency requirements for CBIP.

Seal

Check One

☐ 1. I hereby affirm that I am eligible, under the provisions of the authorities having jurisdiction, to sign this document as the person responsible for its preparation; and that I am licensed as a civil engineer, mechanical engineer, electrical engineer or architect.

☐ 2. I affirm that I am eligible to sign this document as the person responsible for its preparation; and for the following reason:

COORDINATING PROFESSIONAL	SIGNATURE	DATE
Gordon Sinclair		

CALCULATION RESULTS - ANNUAL ENERGY CONSUMPTION OF PROPOSED BUILDING

Electricity	Natural Gas	Propane	Fuel Oil	Total
330 200 MJ	0 MJ	0 MJ	2 231 480 MJ	2 561 680 MJ

CALCULATION RESULTS - ANNUAL ENERGY CONSUMPTION OF REFERENCE BUILDING

Electricity	Natural Gas	Propane	Fuel Oil	Total
808 790 MJ	0 MJ	0 MJ	2 361 157 MJ	3 169 947 MJ

NOT FOR CBIP COMPLIANCE

SUMMARY COMPLIANCE REPORT

Part 2 of 2

PROJECT NAME	DATE
Yukon Inn Energy Audit	24/06/2002

PEAK ELECTRICAL DEMAND

WINTER			SUMMER		
PROPOSED DESIGN	25.70	kW	PROPOSED DESIGN	23.50	kW
REFERENCE	45.40	kW	REFERENCE	42.40	kW

ENERGY COST SUMMARY

	Electricity	Natural Gas	Propane	Fuel Oil	Total
PPROPOSED	$ 10 839	$ 0	$ 0	$ 28 864	$ 39 703
REFERENCE	$ 26 118	$ 0	$ 0	$ 30 541	$ 56 659

ADVISORY MESSAGES

The CBIP application reviewers should pay special attention to the items specified in this checklist. These items require special written justification and documentation, and special verification to be used with the performance approach. NRCan determines the adequacy of the justification, and may reject a building or design that otherwise complies based on the adequacy of the special justification and documentation submitted.

1: In the Zone Zone 1-level1 N - Light Weight Thermal Mass Weighting Factors have been specified.

2: The Room "heated basement/crawlspace" uses an Occupant Density other than the default value from the Compliance Supplement.

3: The Room "heated basement/crawlspace" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

4: The Room "Hallway" uses an Occupant Density other than the default value from the Compliance Supplement.

5: The Room "Hallway" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

6: The Room "North Hotel Rooms" uses an Occupant Density other than the default value from the Compliance Supplement.

7: The Room "North Hotel Rooms" uses a Service Water Load other than the default value from the Compliance Supplement.

8: The Room "North Hotel Rooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

9: The Room "Hotel room bathrooms" uses an Occupant Density other than the default value from the Compliance Supplement.

10: The Room "Hotel room bathrooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

11: In the Zone Zone 2-level1 S - Light Weight Thermal Mass Weighting Factors have been specified.

12: The Room "heated basement/crawlspace" uses an Occupant Density other than the default value from the Compliance Supplement.

13: The Room "heated basement/crawlspace" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

14: The Room "Hallway" uses an Occupant Density other than the default value from the Compliance Supplement.

15: The Room "Hallway" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

16: The Room "South Hotel Rooms" uses an Occupant Density other than the default value from the Compliance Supplement.

17: The Room "South Hotel Rooms" uses a Service Water Load other than the default value from the Compliance Supplement.

18: The Room "South Hotel Rooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

19: The Room "Hotel room bathrooms" uses an Occupant Density other than the default value from the Compliance Supplement.

20: The Room "Hotel room bathrooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

21: In the Zone Zone 4-level2 N - Light Weight Thermal Mass Weighting Factors have been specified.

22: The Room "Hallway & Stairway" uses an Occupant Density other than the default value from the Compliance Supplement.

23: The Room "Hallway & Stairway" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

24: The Room "North Hotel Rooms" uses an Occupant Density other than the default value from the Compliance Supplement.

25: The Room "North Hotel Rooms" uses a Service Water Load other than the default value from the Compliance Supplement.

26: The Room "North Hotel Rooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

27: The Room "Hotel room bathrooms" uses an Occupant Density other than the default value from the Compliance Supplement.

28: The Room "Hotel room bathrooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

29: In the Zone Zone 5-level2 S - Light Weight Thermal Mass Weighting Factors have been specified.

30: The Room "Hallway & Stairway" uses an Occupant Density other than the default value from the Compliance Supplement.

SUMMARY COMPLIANCE REPORT

Part 2 of 2

PROJECT NAME	DATE
Yukon Inn Energy Audit	24/06/2002

PEAK ELECTRICAL DEMAND

WINTER			SUMMER		
PROPOSED DESIGN	25.70	kW	PROPOSED DESIGN	23.50	kW
REFERENCE	45.40	kW	REFERENCE	42.40	kW

ENERGY COST SUMMARY

	Electricity	Natural Gas	Propane	Fuel Oil	Total
PPROPOSED	$ 10 839	$ 0	$ 0	$ 28 864	$ 39 703
REFERENCE	$ 26 118	$ 0	$ 0	$ 30 541	$ 56 659

ADVISORY MESSAGES

The CBIP application reviewers should pay special attention to the items specified in this checklist. These items require special written justification and documentation, and special verification to be used with the performance approach. NRCan determines the adequacy of the justification, and may reject a building or design that otherwise complies based on the adequacy of the special justification and documentation submitted.

31: The Room "Hallway & Stairway" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

32: The Room "South Hotel Rooms" uses an Occupant Density other than the default value from the Compliance Supplement.

33: The Room "South Hotel Rooms" uses a Service Water Load other than the default value from the Compliance Supplement.

34: The Room "South Hotel Rooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

35: The Room "Hotel room bathrooms" uses an Occupant Density other than the default value from the Compliance Supplement.

36: The Room "Hotel room bathrooms" uses a value for Minimum Outdoor Air other than the default value from the Compliance Supplement.

37: Warning messages have been reported by the DOE-2 calculation engine.

38: The Zone "Zone 5-level2 S" had 188 hours during which the Cooling load was not met in the simulation. It is acceptable to Undersize the Cooling.

DETAILED COMPLIANCE REPORT-Summary

Project Name Yukon Inn Energy Audit **Date** 24/06/2002

ENVELOPE SUMMARY DATA

	Reference	Proposed	Prescriptive Requirements Exceed	Deficient
Gross Wall Area	611 sq.m	611 sq.m		
Total Window Area	107 sq.m	107 sq.m	X	
Gross Roof Area	851 sq.m	851 sq.m		
Total Skylight Area	0 sq.m	0 sq.m	X	
Fenestration to Wall Ratio	0.18	0.18	X	

Overall Thermal Transmittance

	Reference	Proposed	Exceed	Deficient
Wall	186 W/deg C	260 W/deg C		X
Window	300 W/deg C	343 W/deg C		X
Door	0 W/deg C	0 W/deg C	X	
Roof	250 W/deg C	142 W/degC	X	
Skylight	0 W/deg C	0 W/deg C	X	
Above Ground Floor	0 W/deg C	0 W/deg C	X	
Total	737 W/deg C	745 W/deg C		X
Average Heat Loss Coefficient	0.283 W/sq. m-C	0.286 W/sq. m-C		X

LIGHTING SUMMARY DATA

	Reference	Proposed	Prescriptive Requirements Exceed	Deficient
Total Lighting Power	29 425 W	21 783 W	X	
Lighting Power Density (LPD)	11.29 W/sq. m	8.36 W/sq. m	X	

HVAC SUMMARY DATA

Total Heating Capacity by Fuel

	Reference	Proposed
Electricity	0 kW	127 kW
Propane	0 kW	0 kW
Fuel Oil	246 kW	274 kW
Natural Gas	0 kW	0 kW
Heat Pump	0 kW	0 kW
Other	0 kW	0 kW

Total Cooling Capacity by Fuel

Electricity	0 kW	0 kW
Propane	0 kW	0 kW
Fuel Oil	0 kW	0 kW
Natural Gas	0 kW	0 kW
Other	0 kW	0 kW

NOT FOR CBIP COMPLIANCE

DETAILED COMPLIANCE REPORT-Envelope

PROJECT NAME Yukon Inn Energy Audit

DATE 24/06/2002

OPAQUE ASSEMBLIES

Type	Area	U-Value	Construction Assembly	Location / Comments
Underground Wall	100		MNECB Type II: Unfinished	Zone 1-level1 N
Underground Floor	450		MNECB Type I: Heated Slab	Zone 1-level1 N
Exterior Wall	126	0.516	R-11 2x4 walls	Zone 1-level1 N
Underground Wall	100		MNECB Type II: Unfinished	Zone 2-level1 S
Underground Floor	450		MNECB Type I: Heated Slab	Zone 2-level1 S
Exterior Wall	126	0.516	R-11 2x4 walls	Zone 2-level1 S
Roof	66	0.167	Flat Roof	Zone 4-level2 N
Roof	306	0.167	Flat Roof	Zone 4-level2 N
Exterior Wall	126	0.516	R-11 2x4 walls	Zone 4-level2 N
Roof	54	0.167	Flat Roof	Zone 4-level2 N
Roof	66	0.167	Flat Roof	Zone 5-level2 S
Roof	306	0.167	Flat Roof	Zone 5-level2 S
Exterior Wall	126	0.516	R-11 2x4 walls	Zone 5-level2 S
Roof	54	0.167	Flat Roof	Zone 5-level2 S

DETAILED COMPLIANCE REPORT-Envelope

PROJECT NAME Yukon Inn Energy Audit

DATE 24/06/2002

FENESTRATION SURFACES

#	NECB Window Type	Area	U-Value[1]	SHGC	Location / Comments
1	Operable or Fixed w/Sash	4.5	3.250	0.52	Zone 1-level1 N
2	Operable or Fixed w/Sash	22.3	3.190	0.61	Zone 1-level1 N
3	Operable or Fixed w/Sash	4.5	3.250	0.52	Zone 2-level1 S
4	Operable or Fixed w/Sash	22.3	3.190	0.61	Zone 2-level1 S
5	Operable or Fixed w/Sash	4.5	3.250	0.52	Zone 4-level2 N
6	Operable or Fixed w/Sash	22.3	3.190	0.61	Zone 4-level2 N
7	Operable or Fixed w/Sash	4.5	3.250	0.52	Zone 5-level2 S
8	Operable or Fixed w/Sash	22.3	3.190	0.61	Zone 5-level2 S

1. U-Value represents whole assemby (glass, frame, etc)

OVERHANGS AND SIDE FINS

	Window		Overhang				Left Fin			Right Fin		
#	Hgt.	Wd.	Len.	Hgt.	LExt.	RExt.	Dist.	Len.	Hgt.	Dist.	Len.	Hgt.
1	n/a	n/a										
2	n/a	n/a										
3	n/a	n/a										
4	n/a	n/a										
5	n/a	n/a										
6	n/a	n/a										
7	n/a	n/a										
8	n/a	n/a										

DETAILED COMPLIANCE REPORT-Envelope Details

PROJECT NAME: Yukon Inn Energy Audit

DATE: 24/06/2002

COMPONENT DESCRIPTION

ASSEMBLY NAME: R-11 2x4 walls

MNECB TYPE: Wall

ABSORPTIVITY: 0.70

[X] Detailed Input (See Layer By Layer Input Description)

[ ] User Supplied U-Value (See Overall Ratings)

LAYER BY LAYER INPUT DESCRIPTION

	DESCRIPTION	FRAMING	THICK-NESS (mm)	CAVITY (RSI)	FRAME (RSI)	*HEAT CAPACITY WEIGHT (kg/sq. m)	SPECIFIC HEAT (kJ/kgK)	HC (kJ/sq. m-C)
	OUTSIDE SURFACE AIR FILM		—	0.030	0.030	—	—	—
1	Stucco	[ ]	12.7	0.018	0.018	23.59	0.84	19.77
2	Siding, Plywood 9.5 mm Lapped	[ ]	10.0	0.000	0.000	5.12	0.50	2.58
3	Insulation, Glass Fibre, Organic Bonded	[X]	89.0	2.467	0.611	16.95	1.34	22.67
4	Membrane, Vapour-Seal, Plastic Film	[ ]	0.2	0.011	0.011	0.28	1.46	0.41
5	Gypsum Sheathing	[ ]	12.7	0.079	0.079	10.17	1.09	11.08
6		[ ]						
7		[ ]						
8		[ ]						
9		[ ]						
	INSIDE SURFACE AIR FILM		—	0.120	0.120	—	—	—
			SUBTOTAL	2.72	0.87	56.1	TOTAL HC	56.5

FRAMING: Wood

FRAMING PERCENT: 19.00 %

*NOTE: Weight and Specific Heat values for materials penetrated by framing include the effects of the framing members.

OVERALL RATINGS (Adjusted for Framing)

U-VALUE: 0.516

RSI: 1.9

DETAILED COMPLIANCE REPORT-Envelope Details

PROJECT NAME: Yukon Inn Energy Audit

DATE: 24/06/2002

COMPONENT DESCRIPTION

ASSEMBLY NAME: Flat Roof

MNECB TYPE: Roof Type III

ABSORPTIVITY: 0.70

[X] Detailed Input (See Layer By Layer Input Description)

[ ] User Supplied U-Value (See Overall Ratings)

LAYER BY LAYER INPUT DESCRIPTION

	DESCRIPTION	FRAMING	THICK-NESS (mm)	CAVITY (RSI)	FRAME (RSI)	*HEAT CAPACITY WEIGHT (kg/sq. m)	SPECIFIC HEAT (kJ/kgK)	HC (kJ/sq. m-C)
	OUTSIDE SURFACE AIR FILM		—	0.030	0.030	—	—	—
1	Roofing, Asphalt Roll	[ ]	6.0	0.026	0.026	6.72	1.51	10.14
2	Plywood	[ ]	15.9	0.136	0.136	8.64	1.21	10.50
3	Insulation, Glass Fibre, Organic Bonded	[X]	254.0	7.040	1.742	37.98	1.21	46.12
4	Membrane, Vapour-Seal, Plastic Film	[ ]	0.2	0.011	0.011	0.28	1.46	0.41
5	Gypsum Sheathing	[ ]	15.9	0.099	0.099	12.71	1.09	13.84
6		[ ]						
7		[ ]						
8		[ ]						
9		[ ]						
	INSIDE SURFACE AIR FILM		—	0.110	0.110	—	—	—
			SUBTOTAL	7.45	2.15	66.3	TOTAL HC	81.0

FRAMING: Wood

FRAMING PERCENT: 10.00 %

*NOTE: Weight and Specific Heat values for materials penetrated by framing include the effects of the framing members.

OVERALL RATINGS
(Adjusted for Framing)

U-VALUE: 0.167

RSI: 6.0

DETAILED COMPLIANCE REPORT - Lighting

PROJECT NAME: Yukon Inn Energy Audit

DATE: 24/06/2002

LIGHTING SUMMARY DATA

ZONE NAME	SPACE USE CLASSIFICATION	FLOOR AREA (sq. m)	LPD (W/sq. m)	LTG. PWR. (W)	LTG. Area Factor	Fixture Technology
Zone 1-level1 N	Service & Comn - Mech./Electrical	450	6.76	3 043	1.20	Incandescent
Zone 1-level1 N	Service & Comn - Corridors	66	6.76	446	1.20	Incandescent
Zone 1-level1 N	Hotel/Motel - Guest Rooms	307	6.76	2 076	1.20	Incandescent
Zone 1-level1 N	Service & Comn - Tlt./Washrooms	54	6.76	362	1.20	Incandescent
Zone 2-level1 S	Service & Comn - Mech./Electrical	450	6.76	3 043	1.20	Incandescent
Zone 2-level1 S	Service & Comn - Corridors	66	6.76	446	1.20	Incandescent
Zone 2-level1 S	Hotel/Motel - Guest Rooms	307	6.76	2 076	1.20	Incandescent
Zone 2-level1 S	Service & Comn - Tlt./Washrooms	54	6.76	362	1.20	Incandescent
Zone 4-level2 N	Service & Comn - Corridors	66	11.65	768	1.20	Incandescent
Zone 4-level2 N	Hotel/Motel - Guest Rooms	307	11.65	3 576	1.20	Incandescent
Zone 4-level2 N	Service & Comn - Tlt./Washrooms	54	11.65	624	1.20	Incandescent
Zone 5-level2 S	Service & Comn - Corridors	66	11.65	768	1.20	Incandescent
Zone 5-level2 S	Hotel/Motel - Guest Rooms	307	11.65	3 576	1.20	Incandescent
Zone 5-level2 S	Service & Comn - Tlt./Washrooms	54	11.65	624	1.20	Incandescent

Basis For Space Use Classification

☐ Building Type ☒ Space Function

PAGE TOTAL 21 791 W

BUILDING TOTAL 21 791 W

NOT FOR CBIP COMPLIANCE

DETAILED COMPLIANCE REPORT- PRIMARY & TERMINAL SYSTEMS

PROJECT NAME: Yukon Inn Energy Audit

DATE: 24/06/2002

SERVICE WATER SUMMARY

System Name	Fuel Source	Volume (L)	Input (kW)	Thermal Eff.
Area #1	Oil	1 816	60.0	84.6%

PRIMARY EQUIPMENT SUMMARY

Description	Equipment Type	Qty.	Fuel Source	Efficiency	Output (kW)	PUMPS				
						Head (kPa)	Temp Drop	Pump Eff.	Motor Eff.	Pump Control
Avg. oil boiler 90+134kW	Boiler	2	Oil	84.6% TE	137.0	150	11	70.0%	85.0%	Fixed Speed

ZONE TERMINAL SUMMARY

Zone Name	Terminal Type	Heating Source	Output (kW)		Efficiency (COP)		AIR FLOW		TERMINAL FAN	
			Heating	Cooling	Heating	Cooling	MAX. L/s	MIN. L/s	L/s	W
Zone 1-level1 N	4 Pipe Fan Coil	n/a	42.4	0.0	3.00	3.00	n/a	n/a	1 781	0
Zone 2-level1 S	4 Pipe Fan Coil	n/a	42.4	0.0	3.00	3.00	n/a	n/a	1 781	0
Zone 4-level2 N	4 Pipe Fan Coil	n/a	21.2	0.0	3.00	3.00	n/a	n/a	867	0
Zone 5-level2 S	4 Pipe Fan Coil	n/a	21.2	0.0	3.00	3.00	n/a	n/a	867	0

EXHAUST FAN SUMMARY

EXHAUST FAN			
Room Name	Qty.	L/s	W
North Hotel Rooms	6	2	6
Hotel room bathrooms	12	1	8
South Hotel Rooms	6	2	6

EXHAUST FAN			
Room Name	Qty.	L/s	W
Hotel room bathrooms	12	1	8
North Hotel Rooms	6	2	6
Hotel room bathrooms	12	1	8

DETAILED COMPLIANCE REPORT- PRIMARY & TERMINAL SYSTEMS

PROJECT NAME: Yukon Inn Energy Audit | DATE: 24/06/2002

SERVICE WATER SUMMARY

System Name	Fuel Source	Volume (L)	Input (kW)	Thermal Eff.

PRIMARY EQUIPMENT SUMMARY

Description	Equipment Type	Qty.	Fuel Source	Efficiency	Output (kW)	PUMPS				
						Head (kPa)	Temp Drop	Pump Eff.	Motor Eff.	Pump Control

ZONE TERMINAL SUMMARY

Zone Name	Terminal Type	Heating Source	Output (kW)		Efficiency (COP)		AIR FLOW		TERMINAL FAN	
			Heating	Cooling	Heating	Cooling	MAX. L/s	MIN. L/s	L/s	W

EXHAUST FAN SUMMARY

EXHAUST FAN				EXHAUST FAN			
Room Name	Qty.	L/s	W	Room Name	Qty.	L/s	W
South Hotel Rooms	6	2	6				
Hotel room bathrooms	12	1	8				

NOT FOR CBIP COMPLIANCE

DETAILED COMPLIANCE REPORT - SECONDARY SYSTEMS

PROJECT NAME: Yukon Inn Energy Audit

DATE: 24/06/2002

SYSTEM FEATURES

	MECHANICAL SYSTEMS		
SYSTEM NAME	4-pipe fan coil		
SYSTEM TYPE	4 Pipe Fan Coil		
HEATING TYPE	Hot Water		
HEATING COIL CONTROL	n/a		
HEATING OUTPUT (kW)	120.2		
AUXILIARY ELECTRIC (kW)	n/a		
HOT DECK TEMPERATURE (C)	n/a		
HEATING EFFICIENCY	n/a		
COOLING COIL CONTROL	n/a		
COOLING OUTPUT (kW)	n/a		
COLD DECK TEMPERATURE (C)	n/a		
COOLING EFFICIENCY	n/a		
OUTDOOR AIR	Constant Minimum Flowrate		
MAX. OUTDOOR AIR RATIO	n/a		
ECONOMIZER TYPE	n/a		
OUTDOOR LIMIT TEMPERATURE (C)	n/a		
LOCKOUT ECONOMIZER	n/a		
EXHAUST AIR RECOVERY EFF.	0%		
SUPPLY FAN OPERATION	Operating Schedule		
SUPPLY FAN CONTROL	n/a		
AIR FLOW (L/s)	944		
DESIGN FAN POWER (W)	559		
STATIC PRESSURE (Pa)	n/a		
COMBINED EFFICIENCY	n/a		
MECHANICAL EFFICIENCY	n/a		
SUPPLY FAN PLACEMENT	n/a		
MOTOR OUTSIDE AIR STREAM	n/a		
FAN POWER INCLUDED IN RATINGS?	No		
RETURN FAN STATIC PRESSURE (Pa)	n/a		
RETURN FAN COMBINED EFF.	n/a		
PREHEAT SOURCE	n/a		
TEMPERATURE SETPOINT (C)	n/a		
REHEAT/BASEBOARD TYPE	n/a		
INDUCTION RATIO	n/a		

MECHANICAL SYSTEM SIZING REPORT

PROJECT NAME: Yukon Inn Energy Audit

DATE: 24/06/2002

LOADS SUMMARY

SYSTEM NAME	ZONE NAME	FLOOR AREA (sq. m)	HEATING			COOLING				AIRFLOW	
			Sizing Margin	Load[1] (kW)	Airflow (L/s)	Sizing Margin	Sensible (kW)	Latent (kW)	Airflow (L/s)	Code[2] (L/s)	OA (L/s)
Area #1 HVAC		2 606	1.00	74.9	1 242	1.00	0.3	-11.3	1 242	5 295	1 242
	Zone 1-level1 N	876	1.00	17.9	1 781	1.00	9.2	0.5	1 781	1 781	367
	Zone 2-level1 S	876	1.00	17.9	1 781	1.00	17.3	0.5	1 781	1 781	367
	Zone 4-level2 N	426	1.00	17.4	867	1.00	7.5	0.4	867	867	254
	Zone 5-level2 S	426	1.00	17.4	867	1.00	15.3	0.4	867	867	254

1. Heating Loads shown for VAV and distributed heat pump and fancoil systems are for tempering outdoor air only.
2. Code Airflow column lists the 2 L/s-sqm minimum airflow requirement for systems with cooling.

1 kW = 3,413 Btu/hr
1 L/s = 2.119 CFM

Yukon Inn Energy Study
Room 231

Date:

5/19/2002

File name	Time	Date
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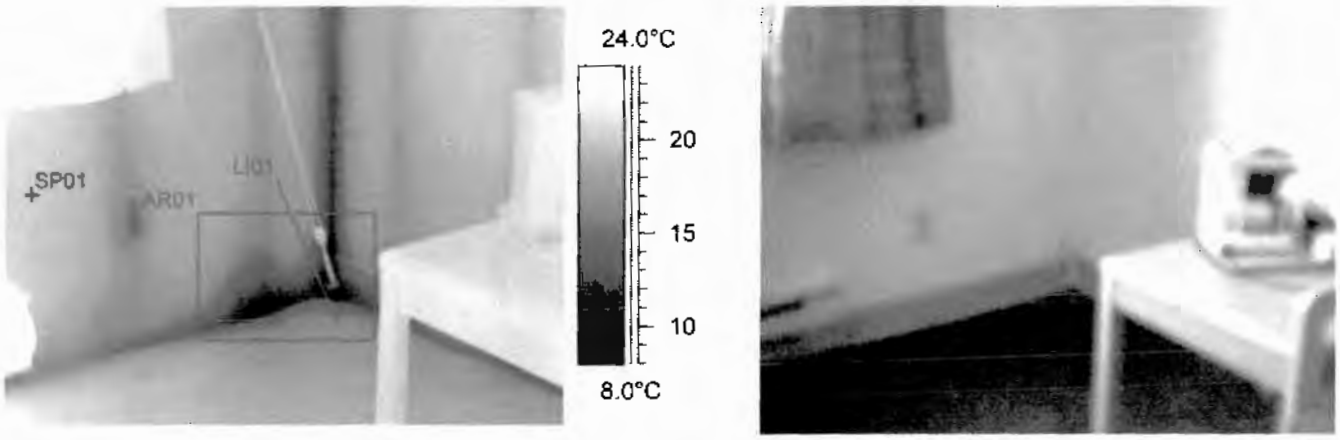
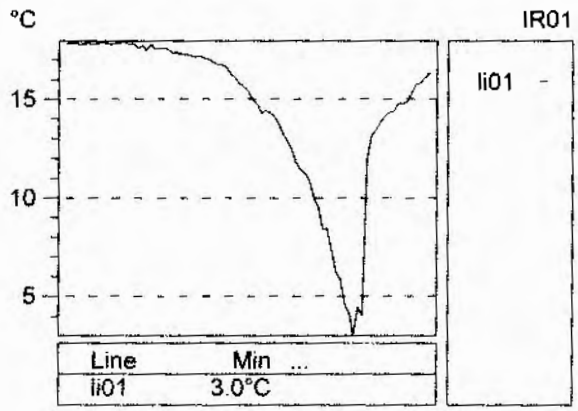


IR Text Comment	Value
Section	Room 231
Equipment	Outside Corner
Additional information	
Fault	Energy loss through framing.
Recommendation	Retrofit Exterior



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	28.4°C	-
IR : min	2.4°C	-
SP01	20.5°C	27.7°C
LI01 : max	18.0°C	25.1°C
LI01 : min	3.0°C	10.2°C
LI01 : max-min	14.9°C	-
AR01 : max	20.2°C	27.4°C
AR01 : min	2.4°C	9.6°C
AR01 : max-min	17.8°C	-
AR01 : avg	14.7°C	21.9°C

File name	Time	Date
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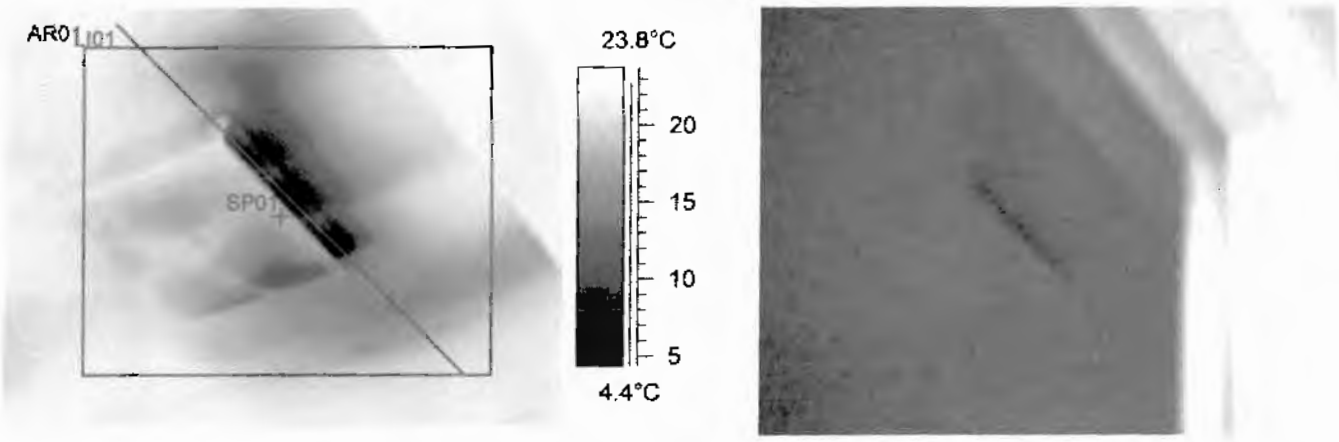
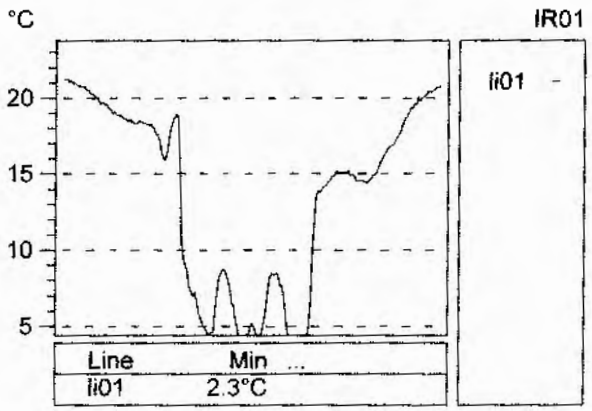


IR Text Comment	Value
Section	Room 231
Equipment	Bathroom Fan
Additional information	
Fault	Air Leakage and Poorly Installed Insulation
Recommendation	Exterior Retrofit



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	22.8°C	-
IR : min	1.6°C	-
SP01	18.1°C	25.3°C
LI01 : max	21.3°C	28.4°C
LI01 : min	2.3°C	9.5°C
LI01 : max-min	18.9°C	-
AR01 : max	22.3°C	29.5°C
AR01 : min	1.6°C	8.7°C
AR01 : max-min	20.7°C	-
AR01 : avg	17.7°C	24.9°C

File name	Time	Date
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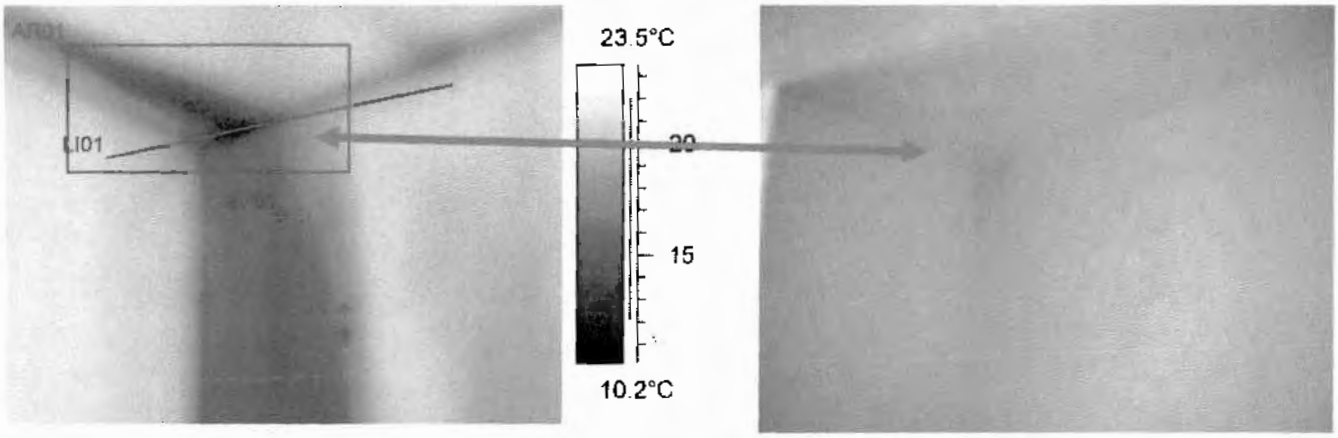
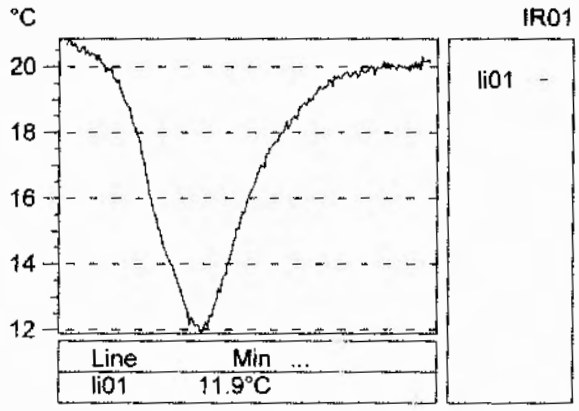


IR Text Comment	Value
Section	Room 231
Equipment	Closet Side Partition
Additional information	
Fault	Air Leakage
Recommendation	Install Air / Vapor Barrier on Exterior



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	22.1°C	-
IR : min	11.9°C	-
SP01	16.1°C	23.3°C
LI01 : max	20.9°C	28.0°C
LI01 : min	11.9°C	19.1°C
LI01 : max-min	9.0°C	-
AR01 : max	21.4°C	28.6°C
AR01 : min	11.9°C	19.1°C
AR01 : max-min	9.5°C	-
AR01 : avg	18.0°C	25.1°C

File name	Time	Date
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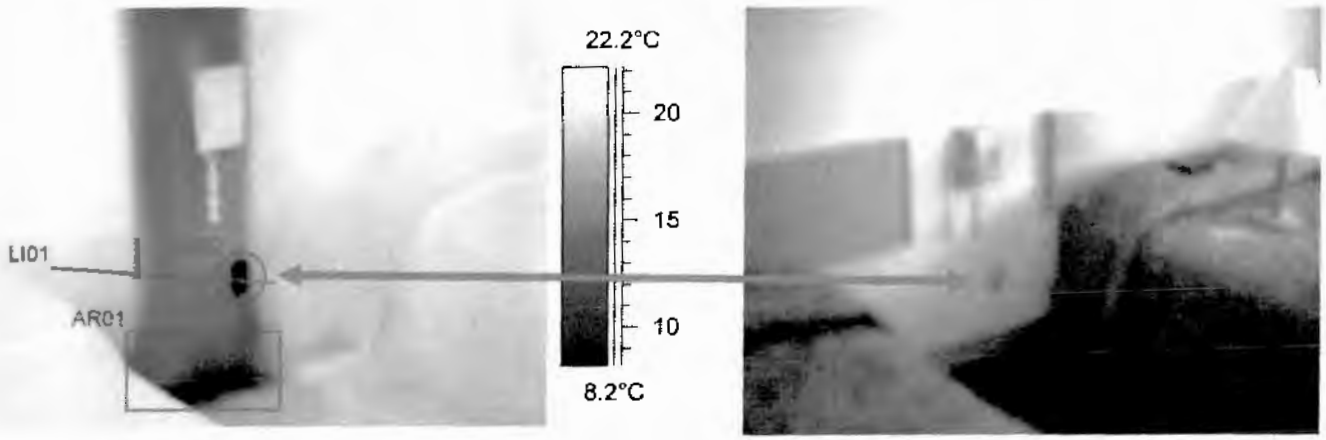
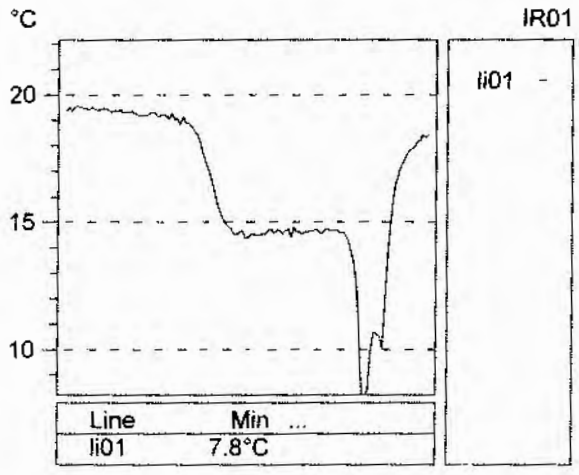


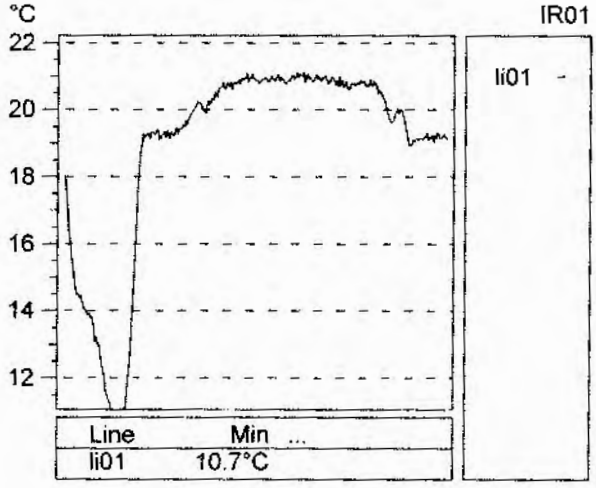
IR Text Comment	Value
Section	Room 231
Equipment	Phone Jack Cavity on Interior Wall
Additional information	Air leakage at interior walls very difficult to seal
...continued	without a majoy exterior retrofit as described in report.
Fault	Air Leakage From Outside
Recommendation	Exterior Retrofit



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	22.3°C	-
IR : min	6.0°C	-
LI01 : max	19.6°C	26.8°C
LI01 : min	7.8°C	14.9°C
LI01 : max-min	11.8°C	-
AR01 : max	20.2°C	27.4°C
AR01 : min	6.0°C	13.2°C
AR01 : max-min	14.2°C	-
AR01 : avg	13.4°C	20.6°C
AR02 : max	18.2°C	25.4°C
AR02 : min	6.6°C	13.7°C
AR02 : max-min	11.6°C	-
AR02 : avg	13.6°C	20.8°C

File name	Time	Date
C0312-15.img	10:41:38 AM	3/12/2002

IR Text Comment	Value
Section	Room 231
Equipment	Phone Cavity on Interior Wall - Upper
Additional information	
Fault	Air Leakage From Outside
Recommendation	Exterior Retrofit



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	21.5°C	-
IR : min	10.3°C	-
LI01 : max	21.1°C	28.3°C
LI01 : min	10.7°C	17.9°C
LI01 : max-min	10.4°C	-

File name	Time	Date
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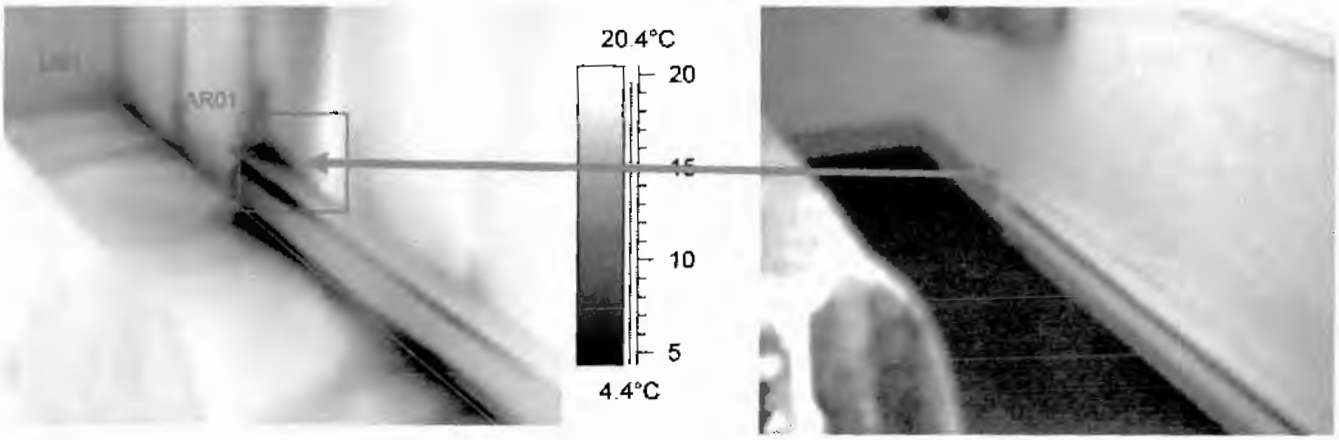
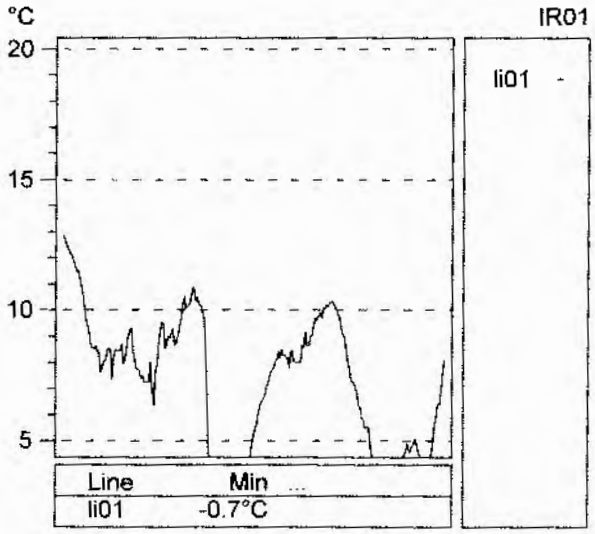


IR Text Comment	Value
Section	Room 231
Equipment	Baseboard and Bottom Plate
Additional information	
Fault	Air Leakage at Bottom Plate
Recommendation	Exterior Retrofit



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	19.7°C	-
IR : min	-0.7°C	-
LI01 : max	12.8°C	20.0°C
LI01 : min	-0.7°C	6.5°C
LI01 : max-min	13.5°C	-
AR01 : max	18.7°C	25.9°C
AR01 : min	0.5°C	7.7°C
AR01 : max-min	18.2°C	-
AR01 : avg	12.6°C	19.8°C

File name	Time	Date
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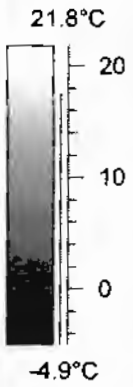
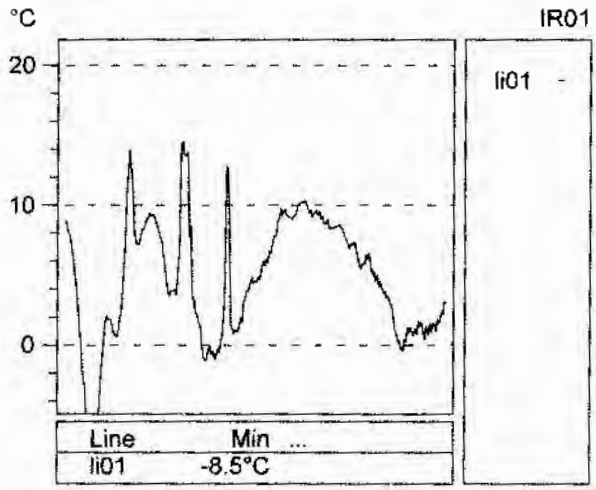


IR Text Comment	Value
Section	Room 231
Equipment	Exterior Wall Behind TV
Additional information	
Fault	Air Leakage and Poorly Installed Insulation
Recommendation	Exterior Retrofit



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	17.6°C	-
IR : min	-8.7°C	-
LI01 : max	14.5°C	21.7°C
LI01 : min	-8.5°C	-1.3°C
LI01 : max-min	23.0°C	-

File name	Time	Date
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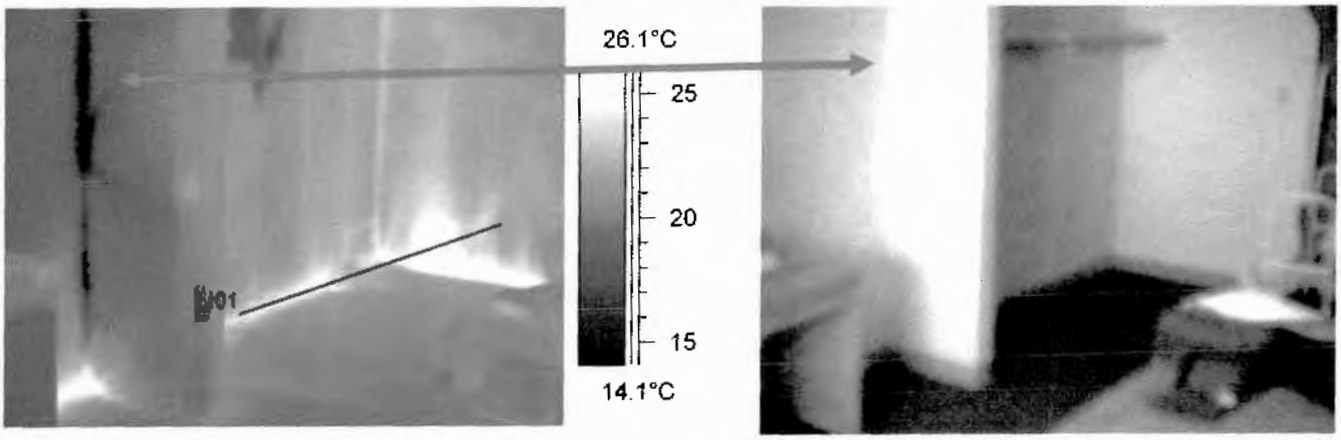
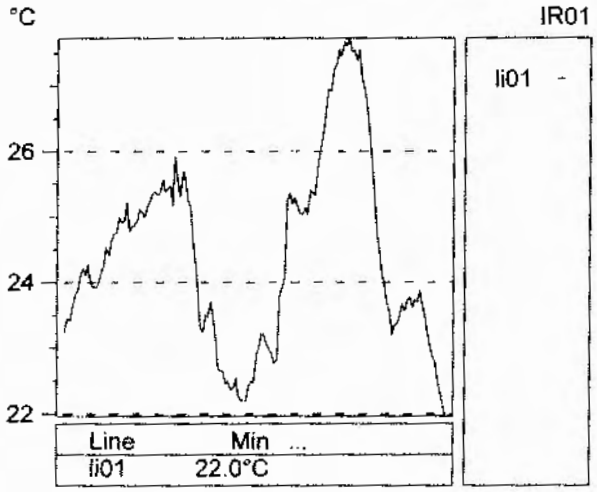
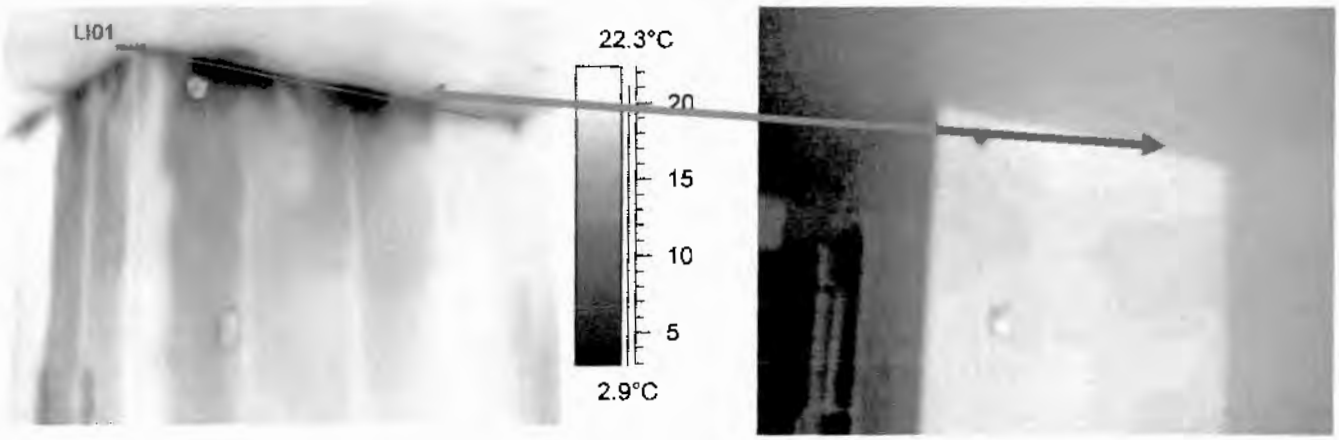


IR Text Comment	Value
Section	Room 231
Equipment	Closet Alcove - Lower
Additional information	
Fault	Hidden Uninsulated Heat Pipe in Wall
Recommendation	Reduce pipe temperature with indoor / outdoor reset aquastat.

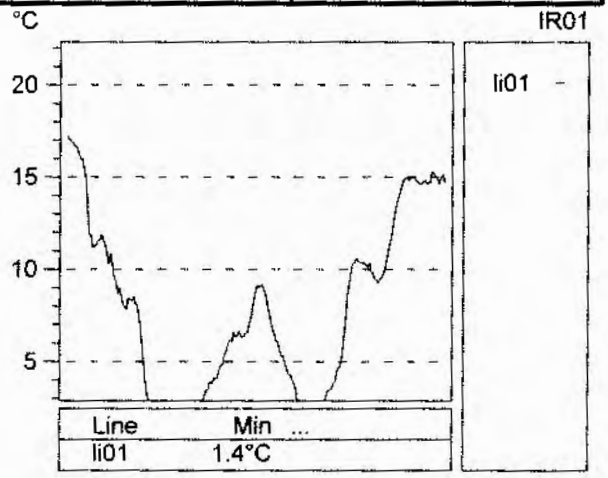


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	30.1°C	-
IR : min	10.3°C	-
LI01 : max	27.7°C	34.9°C
LI01 : min	22.0°C	29.1°C
LI01 : max-min	5.8°C	-
AR01 : max	19.2°C	26.3°C
AR01 : min	10.3°C	17.5°C
AR01 : max-min	8.9°C	-
AR01 : avg	17.1°C	24.3°C

File name	Time	Date
C0312-29.img	10:55:32 AM	3/12/2002



IR Text Comment	Value
Section	Room 231
Equipment	Bathroom Partition
Additional information	
Fault	Air Leakage at top plate
Recommendation	Exterior Retrofit



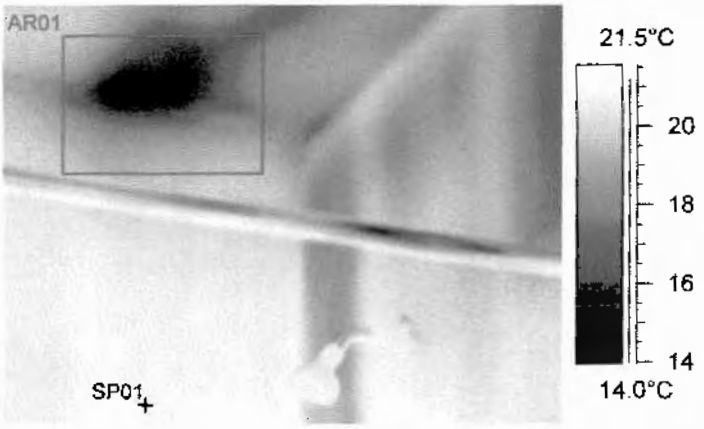
Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	21.2°C	-
IR : min	0.8°C	-
LI01 : max	17.2°C	24.4°C
LI01 : min	1.4°C	8.6°C
LI01 : max-min	15.8°C	-

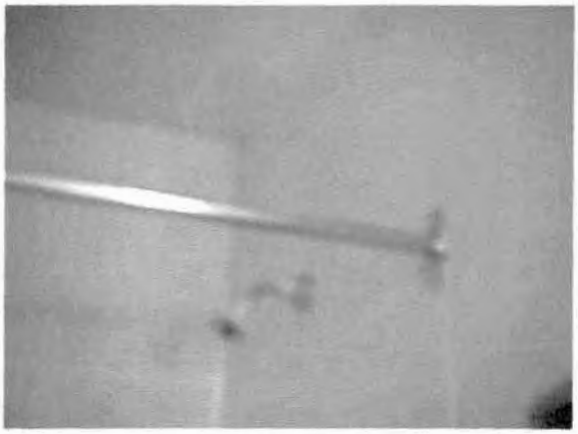
File name	Time	Date
C0312-31.img	10:59:05 AM	3/12/2002

IR Text Comment	Value
Section	Room 231
Equipment	Bathroom @ Vanity
Additional information	
Fault	Air Leakage
Recommendation	Exterior Air Leakage

Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	21.6°C	-
IR : min	6.0°C	-
AR01 : max	19.1°C	26.3°C
AR01 : min	6.8°C	14.0°C
AR01 : max-min	12.3°C	-
AR01 : avg	14.1°C	21.2°C

File name	Time	Date
C0312-35.img	11:02:58 AM	3/12/2002

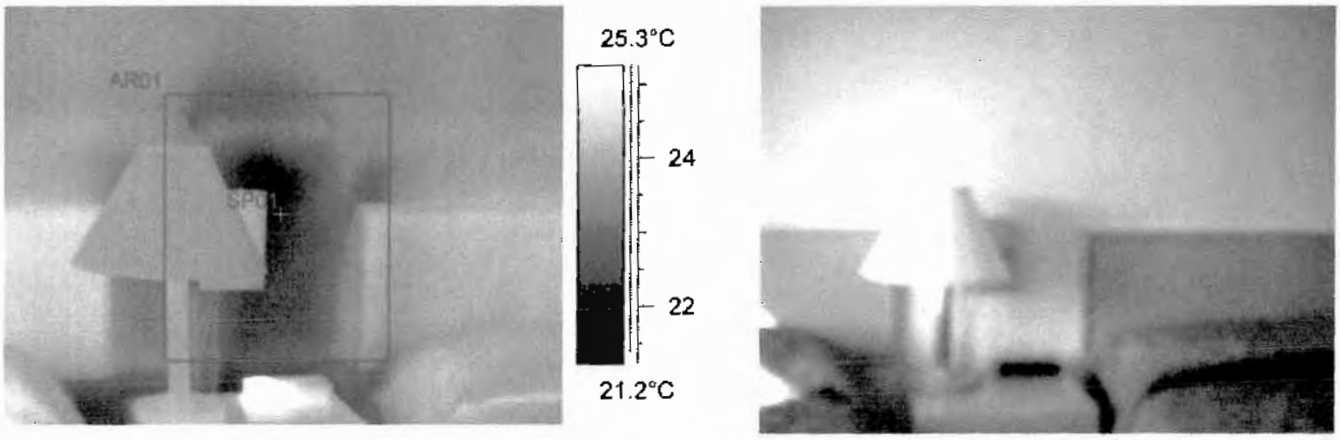




IR Text Comment	Value
Section	Room 231
Equipment	Bathroom Wall Above Towell Rack
Additional information	
Fault	Poorly Installed Insulation and Air Leakage
Recommendation	Exterior Retrofit

Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	21.3°C	-
IR : min	13.1°C	-
SP01	21.0°C	28.2°C
AR01 : max	20.1°C	27.3°C
AR01 : min	13.1°C	20.3°C
AR01 : max-min	7.0°C	-
AR01 : avg	17.3°C	24.5°C

File name	Time	Date
C0312-45.img	2:27:29 PM	3/12/2002



IR Text Comment	Value
Section	Room 229
Equipment	Phone Cavity Opposite Room 231
Additional information	
Fault	Excessive Air Leakage
Recommendation	Exterior Retrofit

Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	28.9°C	-
IR : min	21.3°C	-
SP01	21.8°C	28.9°C
AR01 : max	24.3°C	31.5°C
AR01 : min	21.3°C	28.5°C
AR01 : max-min	3.1°C	-
AR01 : avg	23.1°C	30.3°C

Summary of inspection

Place for general comments.

This quick report uses the Text Comment function
in the ThermaCAM and theThemaCAM Reporter PC software.

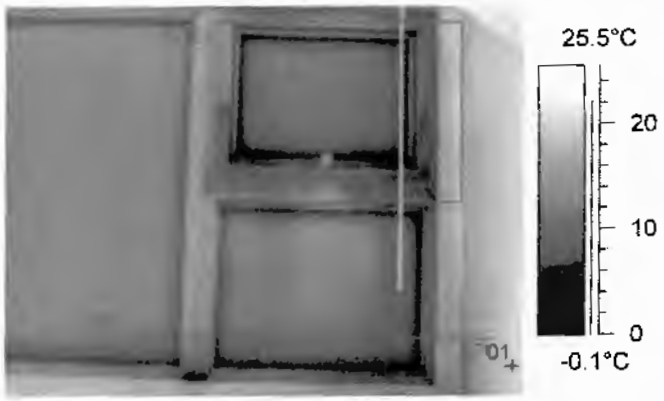
Section	Equipment	Fault	Recommendation
Room 231	Outside Corner	Energy loss through framing	Retrofit Exterior
Room 231	Bathroom Fan	Air Leakage and Poorly Installed Insulation	Exterior Retrofit
Room 231	Closet Side Partition	Air Leakage	Install Air / Vapor Barrier on Exterior
Room 231	Phone Jack Cavity on Interior Wall	without a majoy exterior retrofit as described in report	Air Leakage From Outside
Room 231	Phone Cavity on Interior Wall - Upper	Air Leakage From Outside	Exterior Retrofit
Room 231	Baseboard and Bottom Plate	Air Leakage at Bottom Plate	Exterior Retrofit
Room 231	Exterior Wall Behind TV	Air Leakage and Poorly Installed Insulation	Exterior Retrofit
Room 231	Closet Alcove - Lower	Hidden Uninsulated Heat Pipe in Wall	Reduce pipe temperature with indoor / outdoor reset aquastat
Room 231	Bathroom Partition	Air Leakage at top plate	Exterior Retrofit
Room 231	Bathroom @ Vanity	Air Leakage	Exterior Air Leakage
Room 231	Bathroom Wall Above Towell Rack	Poorly Installed Insulation and Air Leakage	Exterior Retrofit
Room 229	Phone Cavity Opposite Room 231	Excessive Air Leakage	Exterior Retrofit

Infrared Energy Analysis of the Yukon Inn, Whitehorse, Yukon

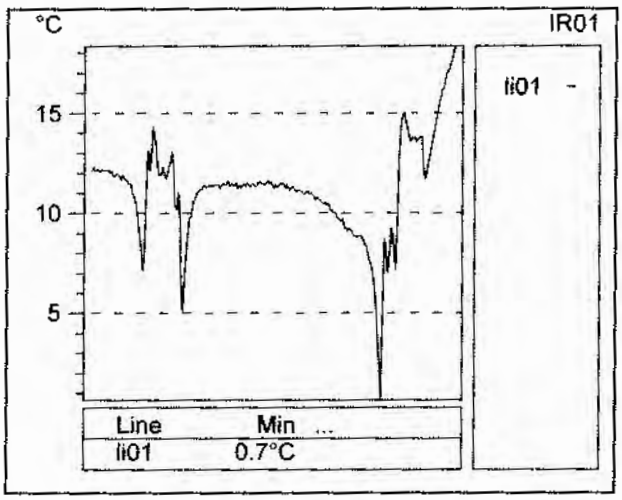
Date:

5/19/2002

File name	Time	Date
C0311-01.img	10:50:08 AM	3/11/2002

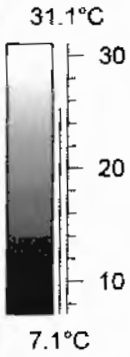


IR Text Comment	Value
Section	Room 143
Equipment	Window
Recommendation	Seal installation air leaks
Additional Information	Remove trim and air seal space between frame and rough opening.

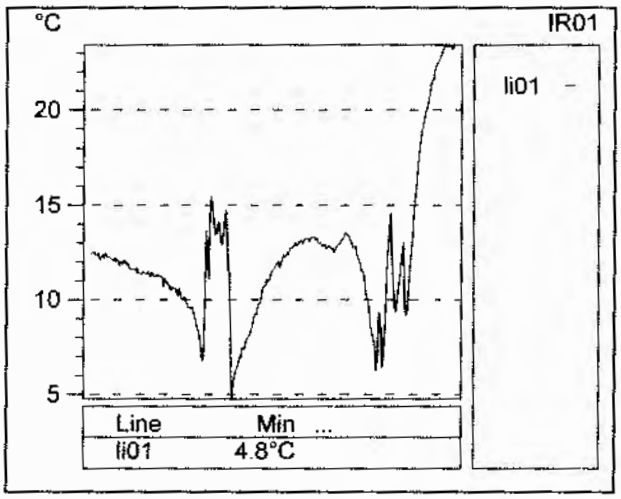


Object parameter	Value	
Emissivity	0.80	-
Object distance	17.6 m	-
Ambient temperature	19.7°C	-
Reference temperature	19.7°C	-
Label	**Value**	**Diff temperature**
IR : max	22.3°C	-
IR : min	-5.4°C	-
SP01	19.7°C	-0.0°C
LI01 : max	18.4°C	-1.3°C
LI01 : min	0.7°C	-19.0°C
LI01 : max-min	17.7°C	-
AR01 : max	19.7°C	-0.0°C
AR01 : min	-5.4°C	-25.1°C
AR01 : max-min	25.1°C	-
AR01 : avg	10.2°C	-9.5°C

File name	Time	Date
C0311-04.img	10:51:25 AM	3/11/2002

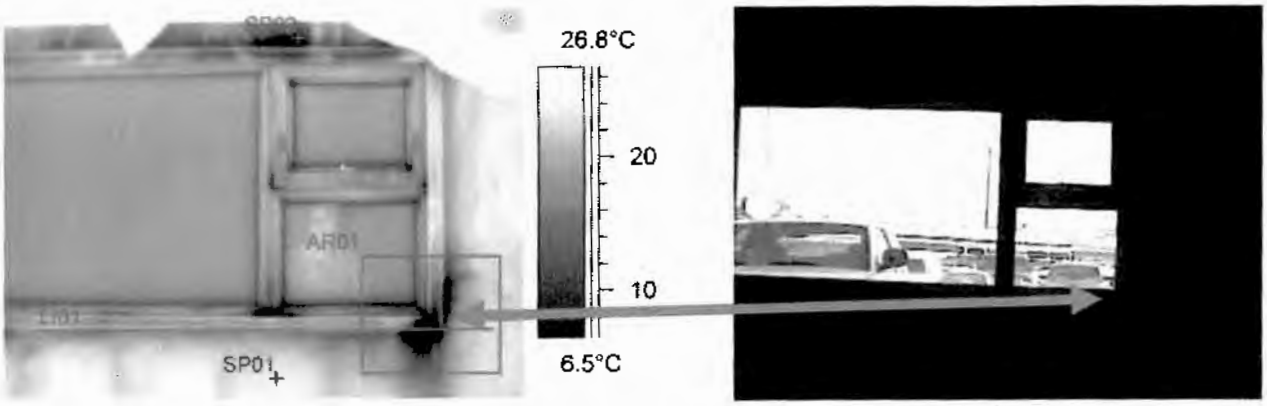


IR Text Comment	Value
Section	Room 143
Equipment	Window @ Corner
Recommendation	Seal installation air leaks
Additional Information	Seal space between frame and rough opening.

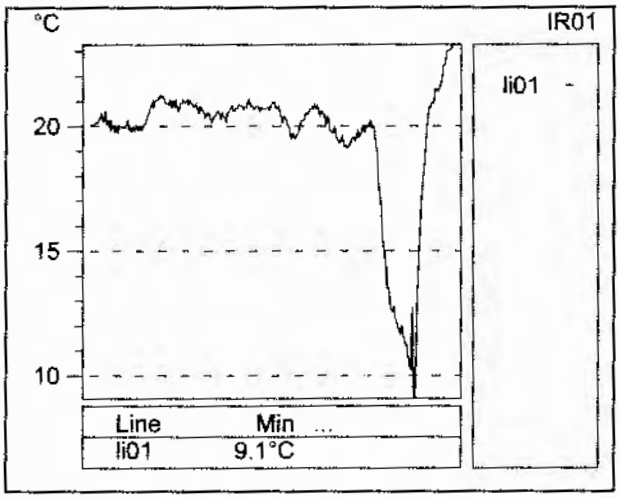


Object parameter	Value	
Emissivity	0.80	-
Object distance	17.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-8.2°C	-
Label	**Value**	**Diff temperature**
IR : max	25.4°C	-
IR : min	-3.4°C	-
LI01 : max	23.4°C	31.6°C
LI01 : min	4.8°C	13.0°C
LI01 : max-min	18.7°C	-
AR01 : max	23.0°C	31.2°C
AR01 : min	-3.4°C	4.8°C
AR01 : max-min	26.4°C	-
AR01 : avg	14.3°C	22.5°C

File name	Time	Date
C0311-10.img	11:06:58 AM	3/11/2002

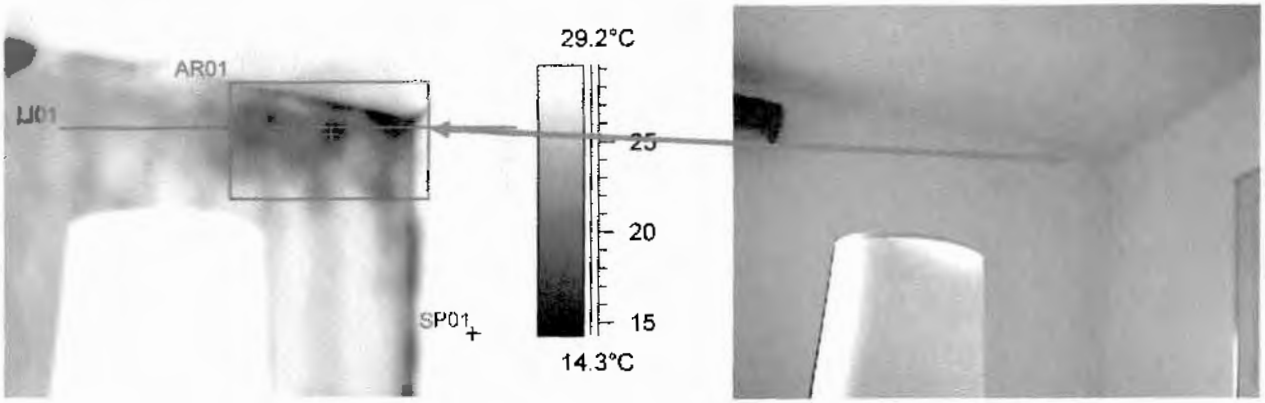


IR Text Comment	Value
Section	Room 141
Equipment	Window
Recommendation	Seal installation leaks
Additional Information	Remove trim and caulk leaks.

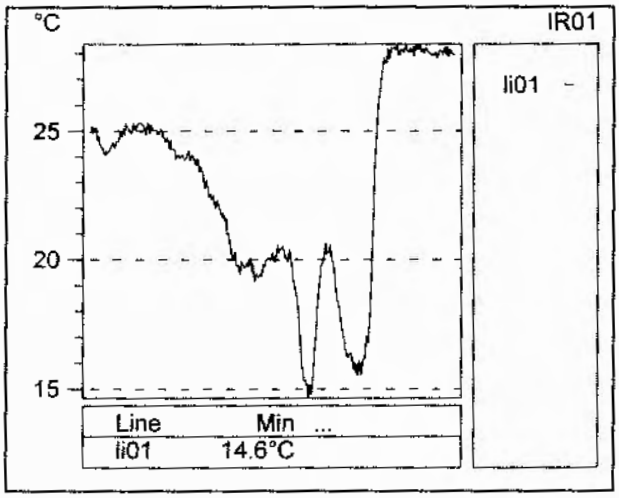


Object parameter	Value	
Emissivity	0.80	-
Object distance	17.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-8.2°C	-
Label	**Value**	**Diff temperature**
IR : max	28.5°C	-
IR : min	-6.8°C	-
SP01	24.0°C	32.2°C
SP02	6.1°C	14.3°C
LI01 : max	23.3°C	31.5°C
LI01 : min	9.1°C	17.3°C
LI01 : max-min	14.2°C	-
AR01 : max	23.5°C	31.7°C
AR01 : min	-6.8°C	1.4°C
AR01 : max-min	30.3°C	-
AR01 : avg	16.7°C	24.9°C

File name	Time	Date
C0311-13.img	11:08:23 AM	3/11/2002

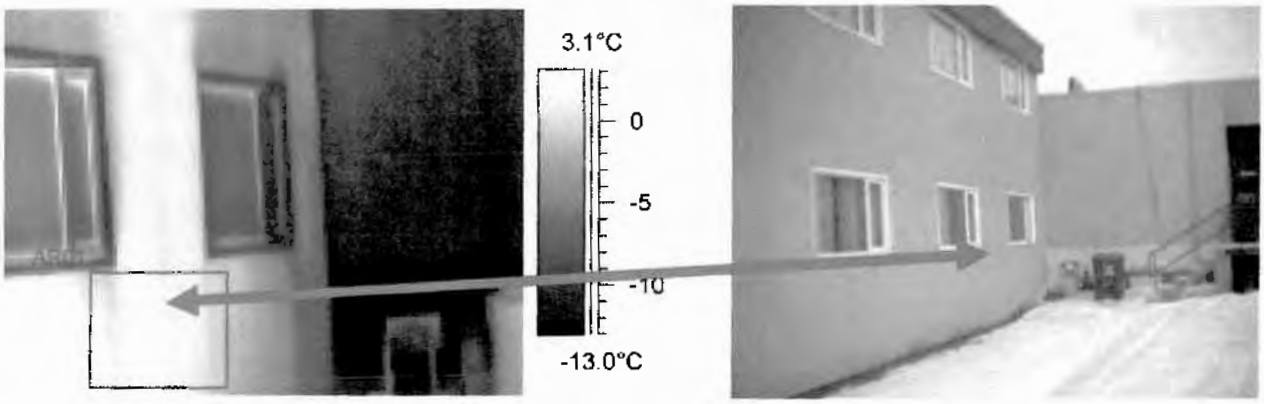


IR Text Comment	Value
Section	Room 143
Equipment	Outside wall upper right corner
Recommendation	Poor insulation
Additional Information	Install rigid foam insulation on exterior & cover w/new siding

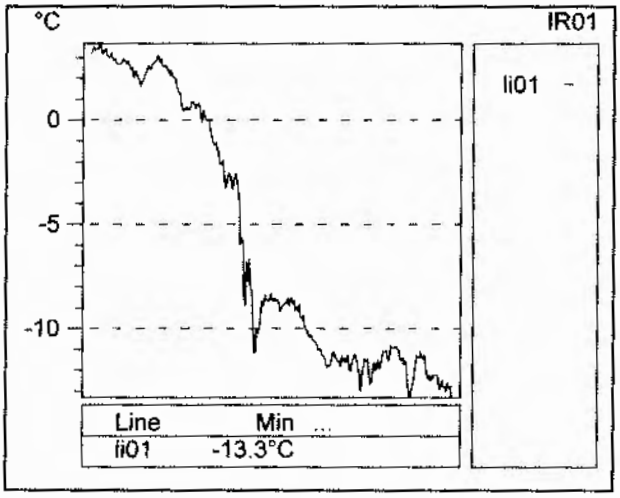


Object parameter	Value	
Emissivity	0.80	-
Object distance	17.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-8.2°C	-
Label	**Value**	**Diff temperature**
IR : max	29.3°C	-
IR : min	13.5°C	-
SP01	28.3°C	36.5°C
SP02	15.8°C	24.0°C
LI01 : max	28.4°C	36.6°C
LI01 : min	14.6°C	22.8°C
LI01 : max-min	13.7°C	-
AR01 : max	28.6°C	36.8°C
AR01 : min	13.5°C	21.7°C
AR01 : max-min	15.1°C	-
AR01 : avg	22.2°C	30.4°C

File name	Time	Date
C0311-19.img	1:24:25 PM	3/11/2002

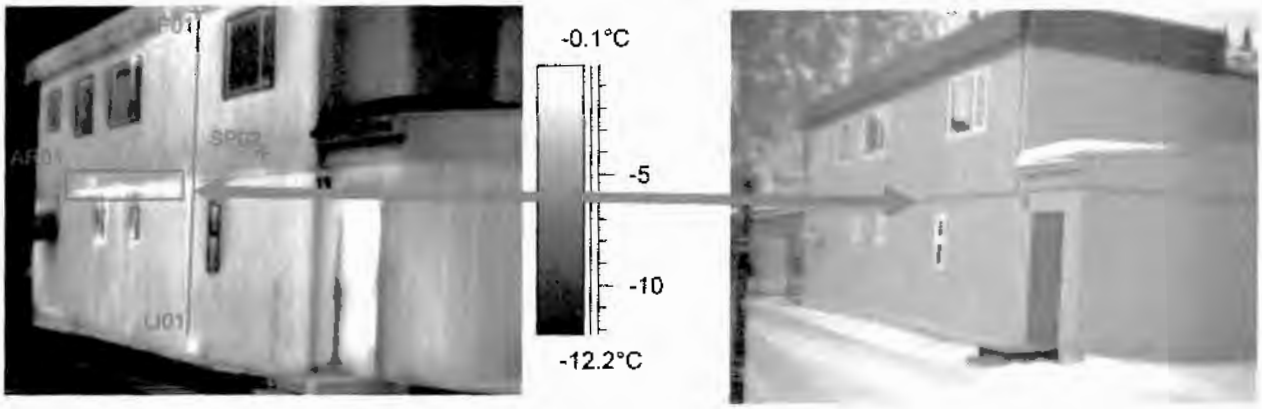


IR Text Comment	Value
Section	Exterior
Equipment	Wall
Recommendation	Insulate on Exterior
Additional Information	Insul. walls on exterior after instal. compl. air/vapour barrie
...continued	Maintain two thirds of the total R-value on the outside.

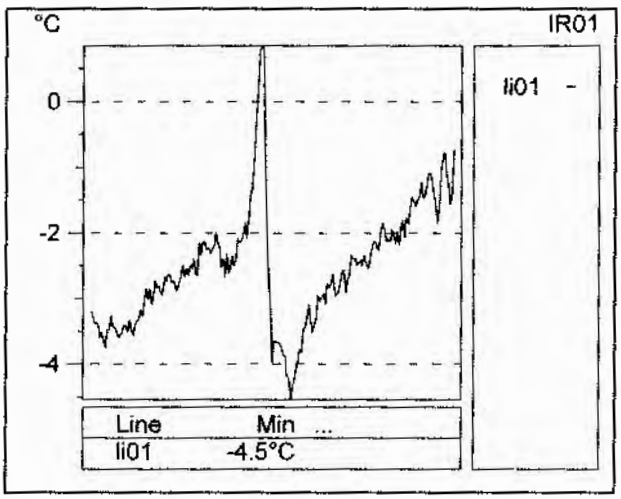


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	4.1°C	-
IR : min	-24.0°C	-
SP01	0.7°C	7.7°C
SP02	1.1°C	8.2°C
LI01 : max	3.7°C	10.8°C
LI01 : min	-13.3°C	-6.2°C
LI01 : max-min	17.0°C	-
AR01 : max	2.4°C	9.5°C
AR01 : min	-1.9°C	5.2°C
AR01 : max-min	4.3°C	-
AR01 : avg	1.0°C	8.1°C

File name	Time	Date
C0311-25.img	1:30:27 PM	3/11/2002

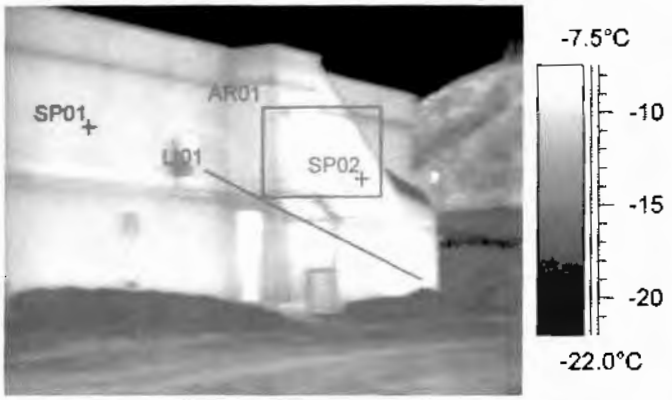


IR Text Comment	Value
Section	Exterior
Equipment	Wall (1st and 2nd level intersection)
Recommendation	Insulation on Exterior
Additional Information	Install rigid foam insulation on exterior & cover w/ new siding

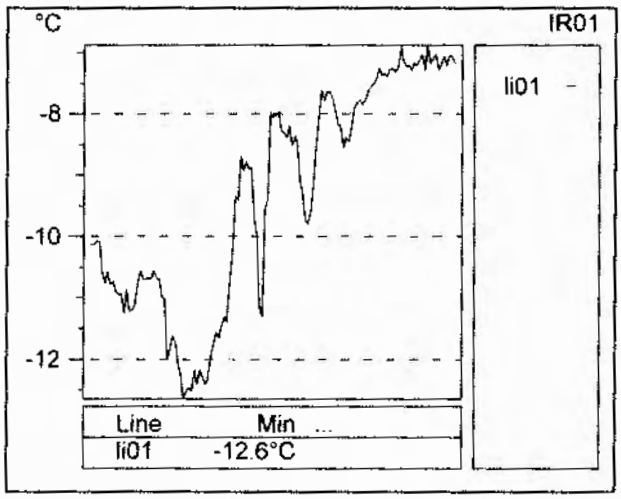


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	6.4°C	-
IR : min	-17.4°C	-
SP01	4.3°C	11.3°C
SP02	-4.1°C	3.0°C
LI01 : max	0.8°C	7.9°C
LI01 : min	-4.5°C	2.5°C
LI01 : max-min	5.4°C	-
AR01 : max	4.2°C	11.2°C
AR01 : min	-5.8°C	1.3°C
AR01 : max-min	9.9°C	-
AR01 : avg	-3.0°C	4.1°C

File name	Time	Date
C0311-31.img	1:34:47 PM	3/11/2002

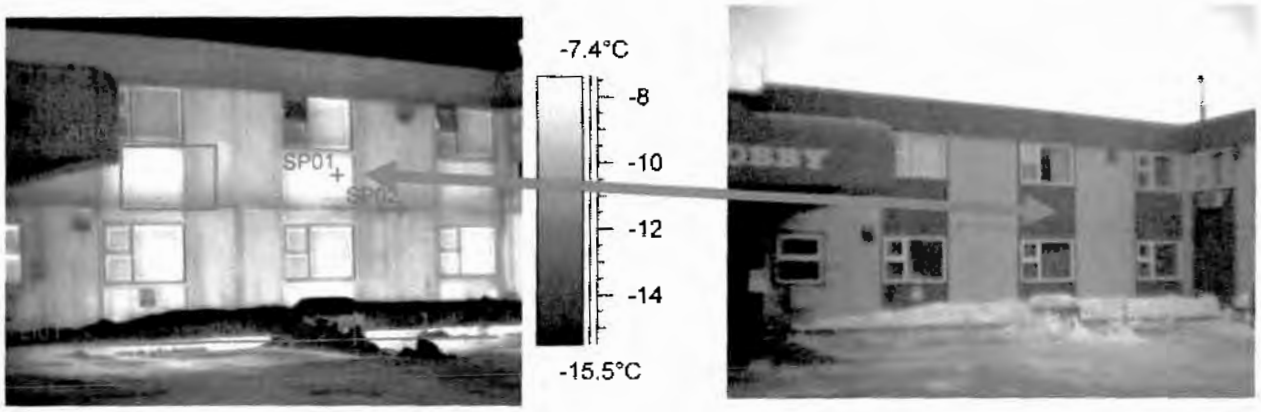


IR Text Comment	Value
Section	Exterior
Equipment	Stairwell
Recommendation	Insulation on Exterior
Additional Information	Install rigid foam insulation on exterior & cover w/ new siding

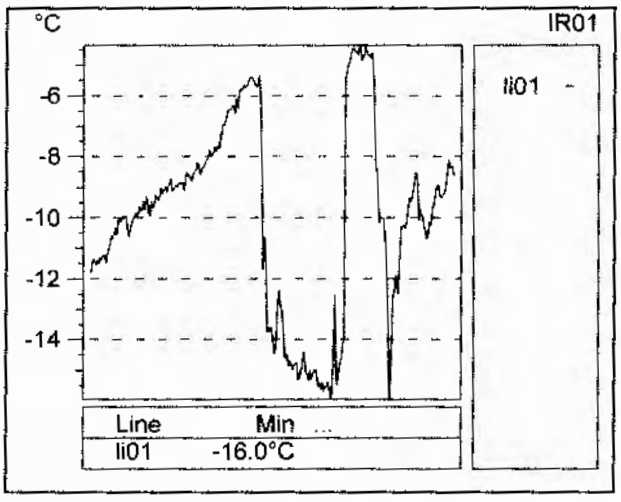


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	-5.5°C	-
IR : min	-26.1°C	-
SP01	-9.6°C	-2.5°C
SP02	-7.4°C	-0.3°C
LI01 : max	-6.9°C	0.2°C
LI01 : min	-12.6°C	-5.6°C
LI01 : max-min	5.8°C	-
AR01 : max	-7.1°C	-0.0°C
AR01 : min	-13.1°C	-6.0°C
AR01 : max-min	6.0°C	-
AR01 : avg	-9.0°C	-2.0°C

File name	Time	Date
C0311-37.img	1:36:17 PM	3/11/2002

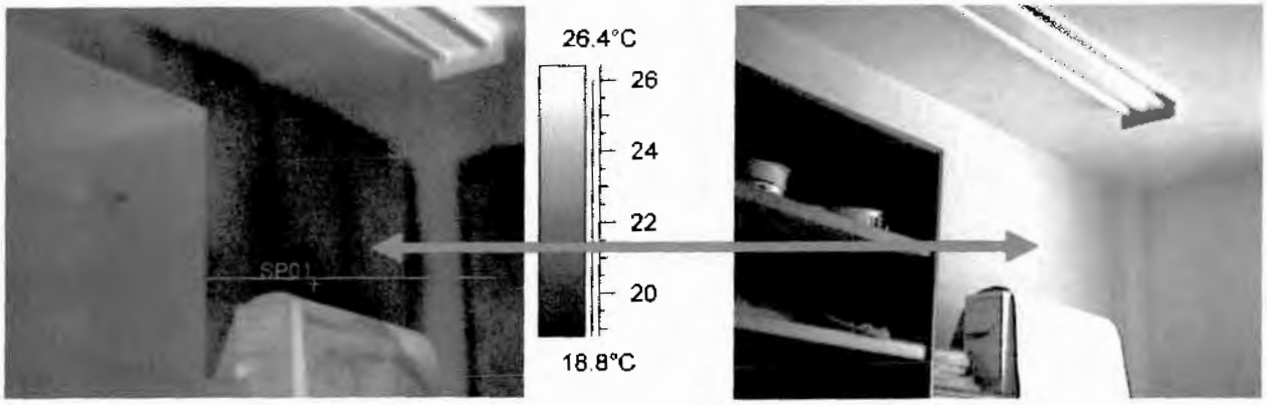


IR Text Comment	Value
Section	Exterior
Equipment	Foundation walls
Recommendation	Insulate Foundation Wall
Additional Information	Excavate .7 m & install 51mm extruded polystryene insulation
...continued	against foundation wall.

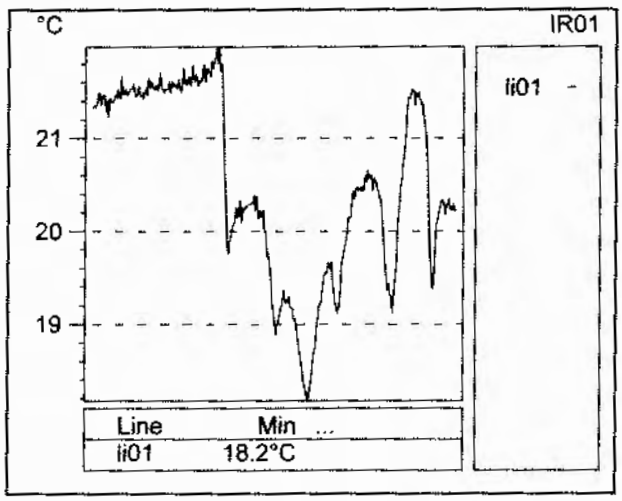


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	1.6°C	-
IR : min	-26.0°C	-
SP01	-7.0°C	0.1°C
SP02	-11.6°C	-4.5°C
LI01 : max	-4.4°C	2.7°C
LI01 : min	-16.0°C	-8.9°C
LI01 : max-min	11.6°C	-
AR01 : max	-7.0°C	0.1°C
AR01 : min	-11.5°C	-4.5°C
AR01 : max-min	4.6°C	-
AR01 : avg	-9.0°C	-1.9°C

File name	Time	Date
C0311-46.img	2:40:36 PM	3/11/2002

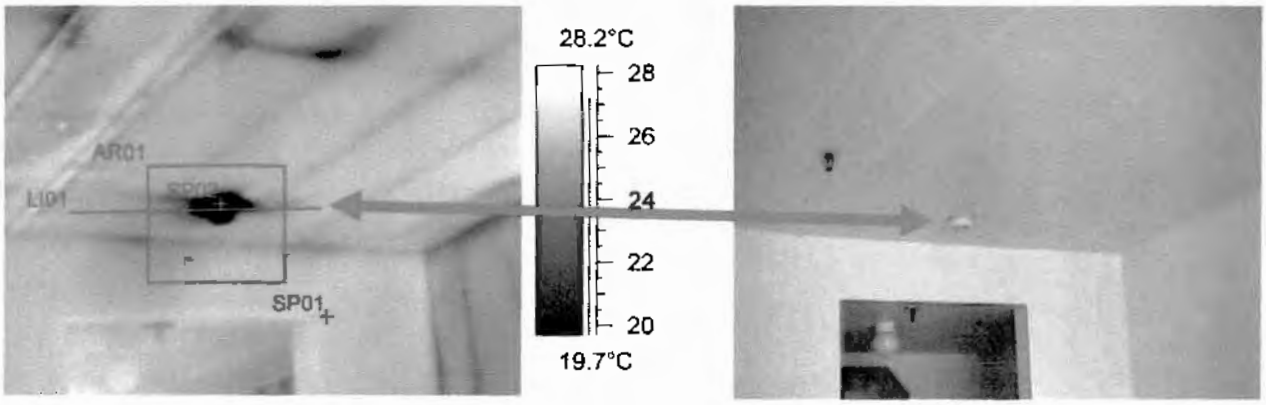


IR Text Comment	Value
Section	Room ?
Equipment	Outside wall
Recommendation	Insulate on Exterior
Additional Information	Install rigid foam insulation on exterior & cover w/ new siding

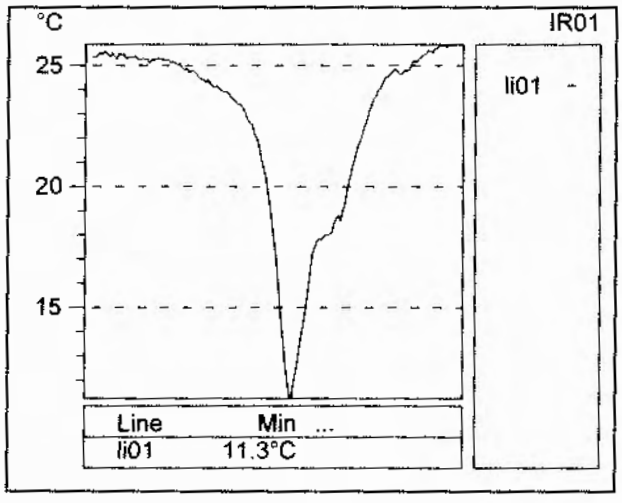


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	26.0°C	-
IR : min	17.6°C	-
SP01	17.8°C	24.9°C
SP02	22.0°C	29.1°C
LI01 : max	22.0°C	29.1°C
LI01 : min	18.2°C	25.2°C
LI01 : max-min	3.8°C	-

File name	Time	Date
C0311-67.img	3:44:30 PM	3/11/2002

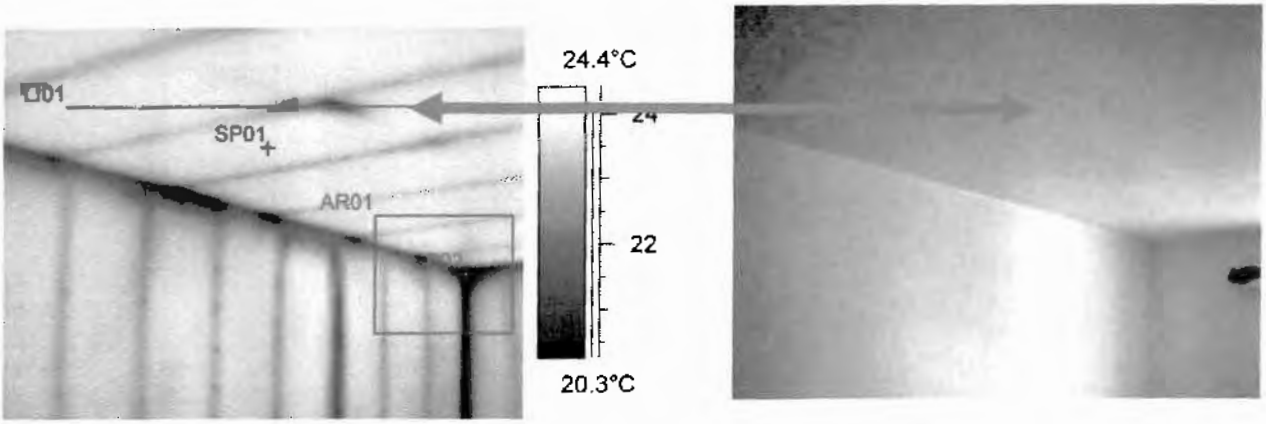


IR Text Comment	Value
Section	Room ?
Equipment	Ceiling
Recommendation	Insulate Attic and Exterior Walls
Additional Information	Blow .3M of cellulose insulation into attic space after sealing
...continued	all air leaks and placing rigid insulation over exterior walls.

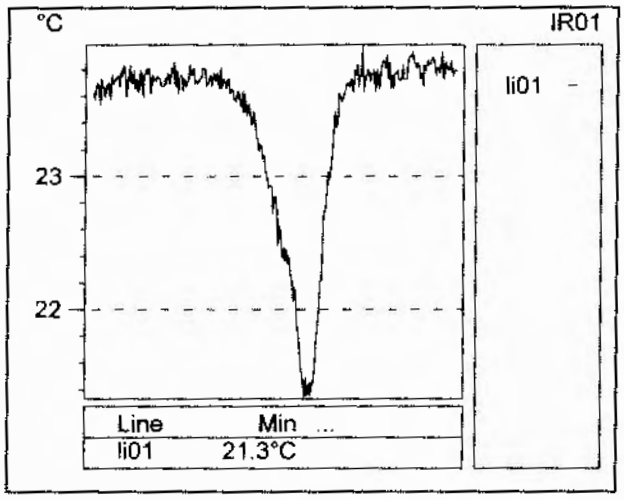


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	27.4°C	-
IR : min	8.2°C	-
SP01	26.0°C	33.1°C
SP02	10.0°C	17.1°C
LI01 : max	25.9°C	32.9°C
LI01 : min	11.3°C	18.3°C
LI01 : max-min	14.6°C	-
AR01 : max	26.3°C	33.4°C
AR01 : min	8.2°C	15.2°C
AR01 : max-min	18.2°C	-
AR01 : avg	24.3°C	31.4°C

File name	Time	Date
C0311-76.img	4:16:56 PM	3/11/2002



IR Text Comment	Value
Section	Room ?
Equipment	Walls & ceiling
Recommendation	Insulate Attic and Exterior Walls
Additional Information	Blow .3M of cellulose insulation into attic space after sealing
...continued	all air leaks and placing rigid insulatin over exterior walls.



Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	24.0°C	-
IR : min	17.7°C	-
SP01	23.9°C	31.0°C
SP02	18.1°C	25.2°C
LI01 : max	24.0°C	31.1°C
LI01 : min	21.3°C	28.4°C
LI01 : max-min	2.7°C	-
AR01 : max	24.0°C	31.1°C
AR01 : min	17.7°C	24.8°C
AR01 : max-min	6.3°C	-
AR01 : avg	23.0°C	30.1°C

Summary of inspection at Yukon Inn, Whitehorse, YT

Equipment	Room	Recommendation	Additional Information
Room 143	Window	Seal installation air leaks	Remove trim and air seal space between frame and rough opening.
Room 143	Window @ Corner	Seal installation air leaks	Seal space between frame and rough opening.
Room 141	Window	Seal installation leaks	Remove trim and caulk leaks.
Room 143	Outside wall upper right corner	Poor insulation	Install rigid foam insulation on exterior & cover w/new siding
Exterior	Wall	Insulate on Exterior	Insul. walls on exterior after instal. compl. air/vapour barrie
Exterior	Wall (1st and 2nd level intersection)	Insulation on Exterior	Install rigid foam insulation on exterior & cover w/ new siding
Exterior	Stairwell	Insulation on Exterior	Install rigid foam insulation on exterior & cover w/ new siding
Exterior	Foundation walls	Insulate Foundation Wall	Excavate .7 m & install 51mm extruded polystyrene insulation
Room ?	Outside wall	Insulate on Exterior	Install rigid foam insulation on exterior & cover w/ new siding
Room ?	Ceiling	Insulate Attic and Exterior Walls	Blow .3M of cellulose insulation into attic space after sealing
Room ?	Walls & ceiling	Insulate Attic and Exterior Walls	Blow .3M of cellulose insulation into attic space after sealing

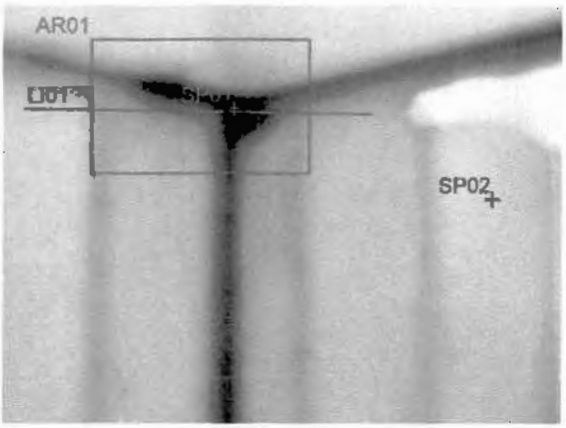
Yukon Inn Energy Study
Room 130

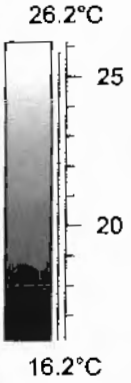
Date:

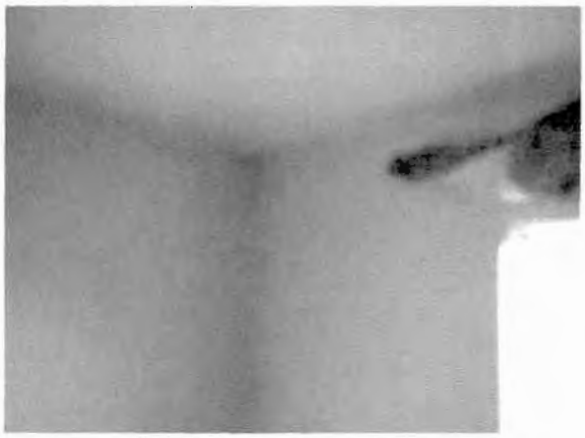
5/19/2002

This report was made with a ThermaCAM from FLIR Systems AB.

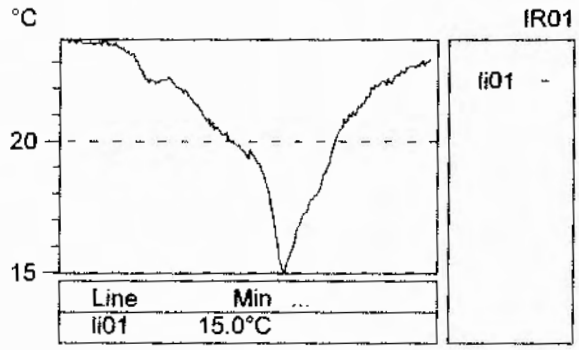
File name	Time	Date
C0312-01.img	8:33:53 AM	3/12/2002





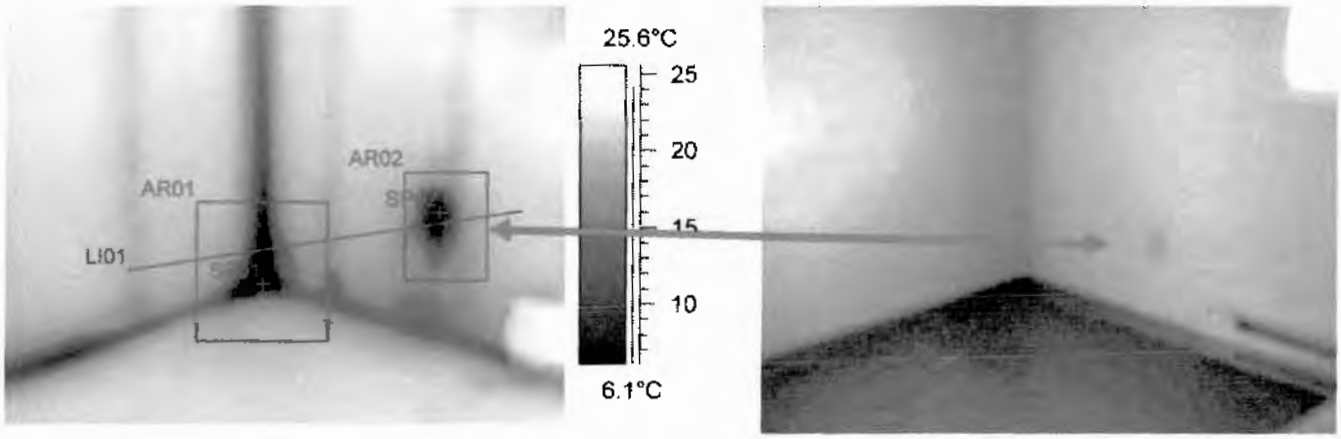


IR Text Comment	Value
Section	Room
Equipment	
Additional information	
Fault	
Recommendation	No action

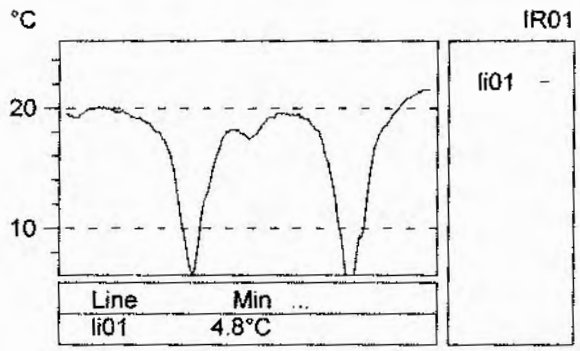


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	26.0°C	-
IR : min	14.2°C	-
SP01	14.9°C	21.9°C
SP02	24.0°C	31.1°C
LI01 : max	23.9°C	30.9°C
LI01 : min	15.0°C	22.1°C
LI01 : max-min	8.9°C	-
AR01 : max	24.3°C	31.4°C
AR01 : min	14.2°C	21.2°C
AR01 : max-min	10.1°C	-
AR01 : avg	21.5°C	28.6°C

File name	Time	Date
C0312-04.img	8:34:16 AM	3/12/2002

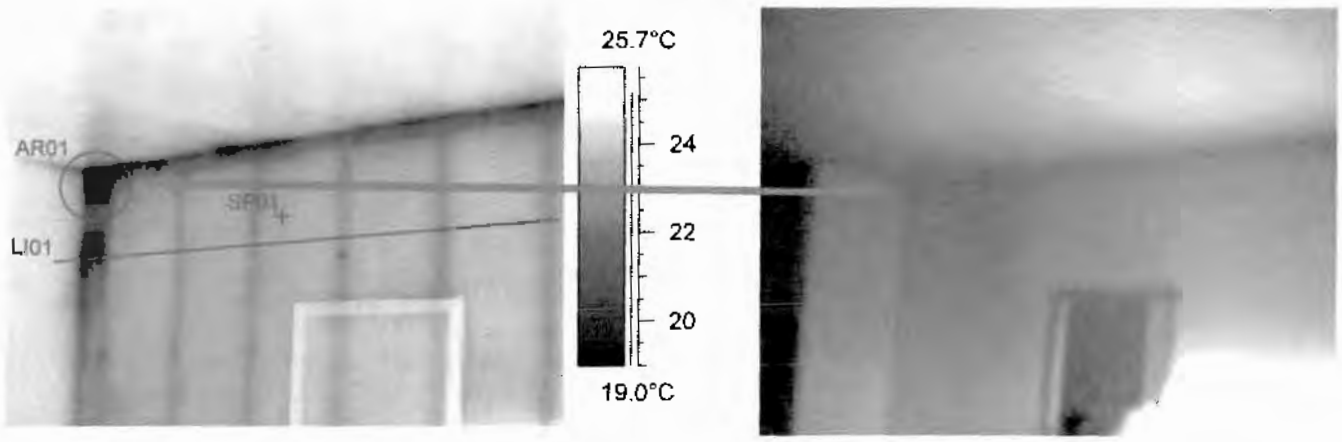


IR Text Comment	Value
Section	Room
Equipment	
Additional information	
Fault	
Recommendation	No action

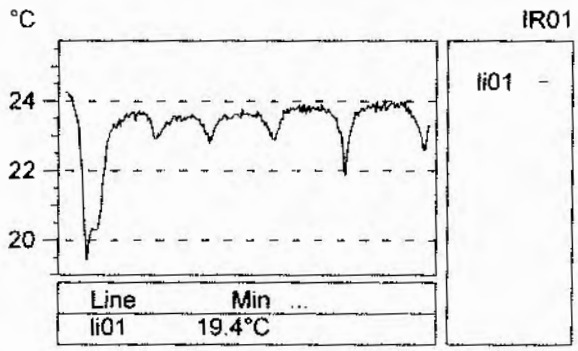


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	24.3°C	-
IR : min	2.4°C	-
SP01	2.8°C	9.9°C
SP02	4.9°C	11.9°C
LI01 : max	21.5°C	28.6°C
LI01 : min	4.8°C	11.9°C
LI01 : max-min	16.7°C	-
AR01 : max	20.6°C	27.7°C
AR01 : min	2.4°C	9.5°C
AR01 : max-min	18.2°C	-
AR01 : avg	16.0°C	23.0°C
AR02 : max	21.4°C	28.5°C
AR02 : min	4.8°C	11.9°C
AR02 : max-min	16.6°C	-
AR02 : avg	15.9°C	23.0°C

File name	Time	Date
C0312-07.img	8:35:51 AM	3/12/2002

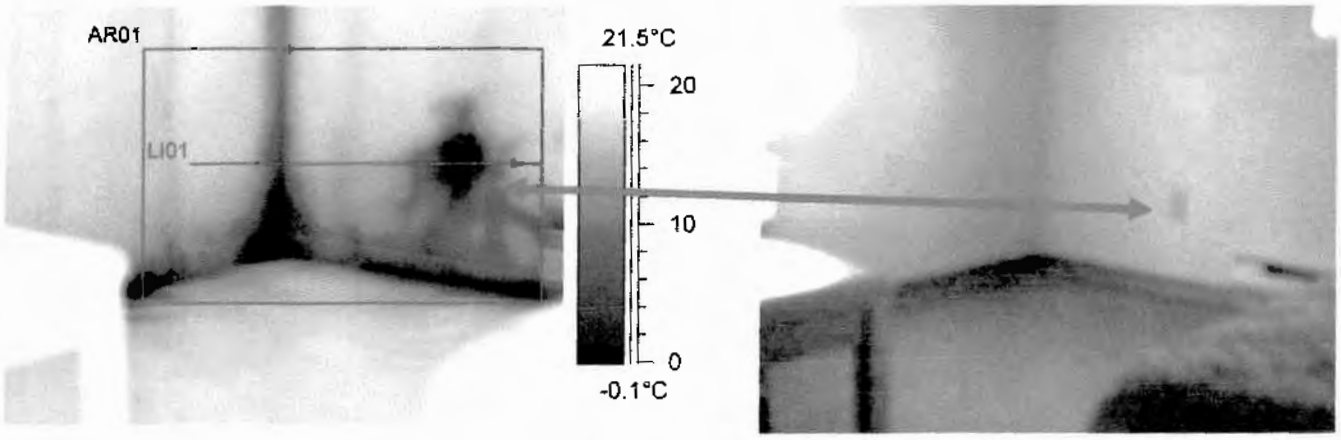


IR Text Comment	Value
Section	Room
Equipment	
Additional information	
Fault	
Recommendation	No action

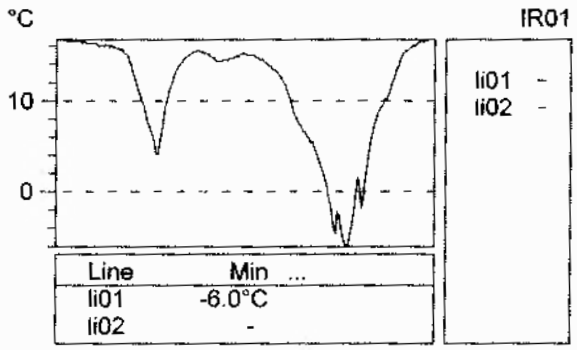


Object parameter	Value	
Emissivity	0.90	-
Object distance	15.6 m	-
Ambient temperature	-8.3°C	-
Reference temperature	-7.1°C	-
Label	**Value**	**Diff temperature**
IR : max	25.4°C	-
IR : min	17.6°C	-
SP01	23.4°C	30.5°C
LI01 : max	24.3°C	31.3°C
LI01 : min	19.4°C	26.5°C
LI01 : max-min	4.8°C	-
AR01 : max	24.1°C	31.2°C
AR01 : min	17.6°C	24.7°C
AR01 : max-min	6.5°C	-
AR01 : avg	21.5°C	28.6°C

File name	Time	Date
C0312-13.img	8:54:08 AM	3/12/2002

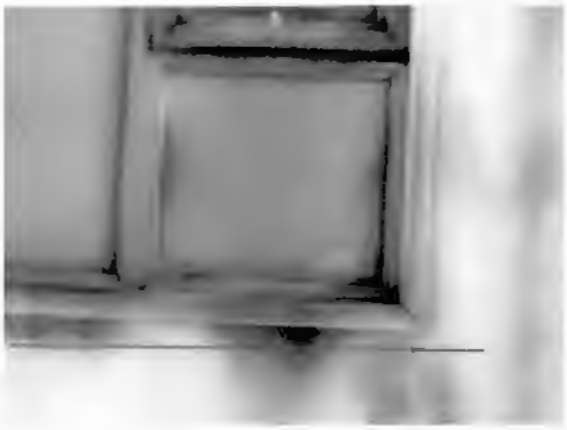


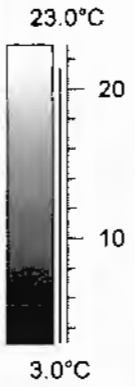
IR Text Comment	Value
Section	Room
Equipment	
Additional information	
Fault	
Recommendation	No action



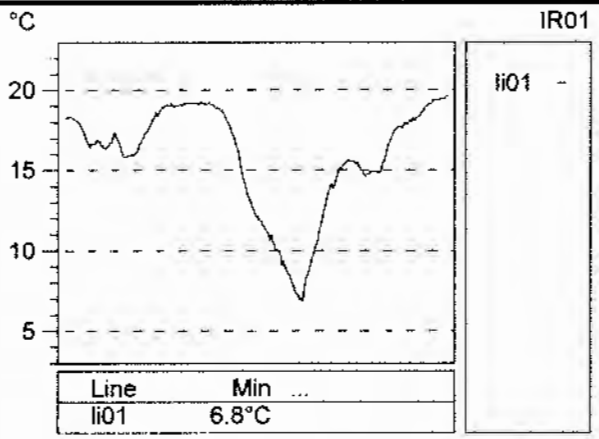
Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	21.6°C	-
IR : min	-10.2°C	-
LI01 : max	16.7°C	23.9°C
LI01 : min	-6.0°C	1.1°C
LI01 : max-min	22.7°C	-
AR01 : max	18.8°C	25.9°C
AR01 : min	-10.2°C	-3.0°C
AR01 : max-min	29.0°C	-
AR01 : avg	12.2°C	19.4°C

File name	Time	Date
C0312-15.img	8:56:59 AM	3/12/2002





IR Text Comment	Value
Section	Room
Equipment	
Additional information	
Fault	
Recommendation	No action



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	-7.2°C	-
Label	**Value**	**Diff temperature**
IR : max	21.5°C	-
IR : min	-3.8°C	-
LI01 : max	19.6°C	26.8°C
LI01 : min	6.8°C	14.0°C
LI01 : max-min	12.8°C	-

Summary of room 131 survey

Place for general comments.

Section	Equipment	Fault	Recommendation
Room			No action
Room			No action
Room			No action
Room			No action
Room			No action

Yukon Inn Energy Study
Area # 3

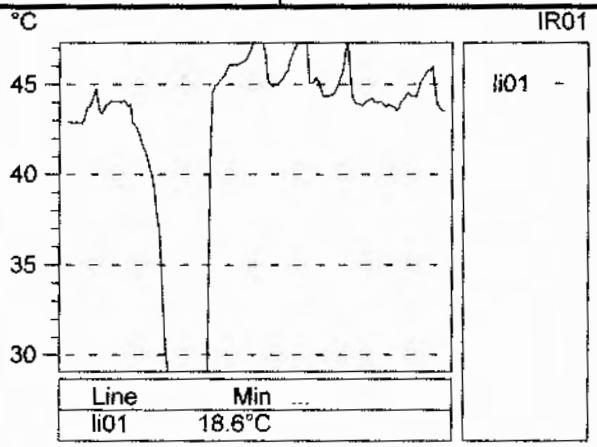
Date:

5/19/2002

This report was made with a ThermaCAM from FLIR Systems AB.

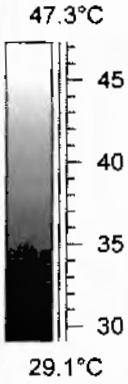
File name	Time	Date
C0315-02.img	1:54:11 PM	3/15/2002

IR Text Comment	Value
Section	Boiler Room Bar
Equipment	Radiant Panel and Windows
Additional information	Room was grossly overheated due to malfunctioning zone valve.
Fault	Heat from panel is lost through double pane windows
Recommendation	Insulate exterior of basement wall and install triple pane glas

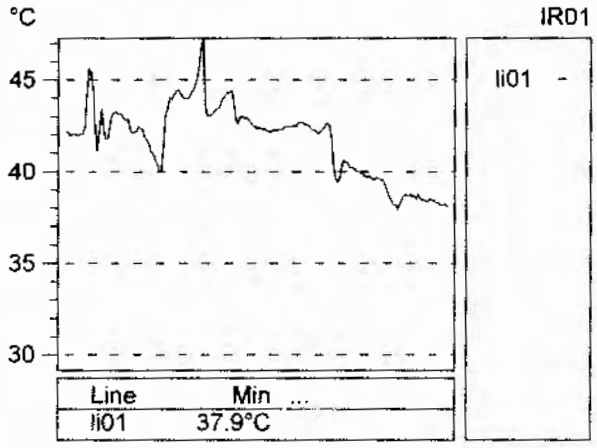


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	51.7°C	-
IR : min	18.5°C	-
LI01 : max	50.7°C	30.3°C
LI01 : min	18.6°C	-1.8°C
LI01 : max-min	32.1°C	-
AR01 : max	51.7°C	31.3°C
AR01 : min	18.5°C	-1.9°C
AR01 : max-min	33.2°C	-
AR01 : avg	42.4°C	22.0°C

File name	Time	Date
C0315-04.img	1:55:03 PM	3/15/2002

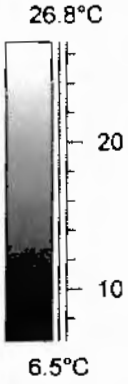


IR Text Comment	Value
Section	Boiler Room Bar
Equipment	View of exterior wall and windows.
Additional information	Room was grossly overheated due to malfunctioning zone valve.
Fault	Heat loss through windows and wall.
Recommendation	Insulate exterior of basement wall and install triple pane glas

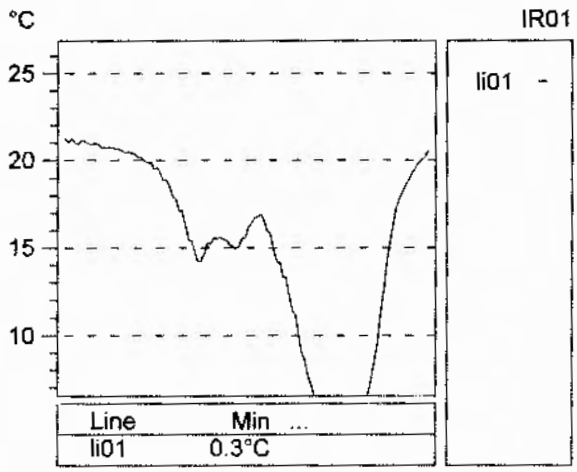


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	62.0°C	-
IR : min	5.6°C	-
LI01 : max	47.5°C	27.2°C
LI01 : min	37.9°C	17.5°C
LI01 : max-min	9.6°C	-
AR01 : max	52.7°C	32.3°C
AR01 : min	5.6°C	-14.8°C
AR01 : max-min	47.1°C	-
AR01 : avg	37.9°C	17.5°C

File name	Time	Date
C0315-06.img	2:37:21 PM	3/15/2002

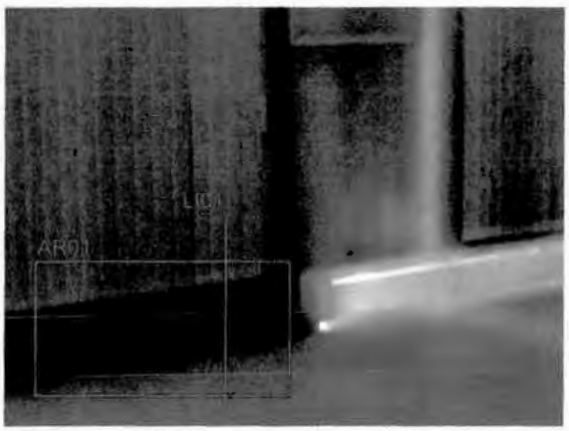


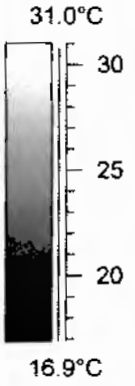
IR Text Comment	Value
Section	Boiler Room Bar
Equipment	Northern Nook and Exterior Door
Additional information	
Fault	High heat loss from air leakage around door.
Recommendation	Install tight fitting weatherstripping around doors.



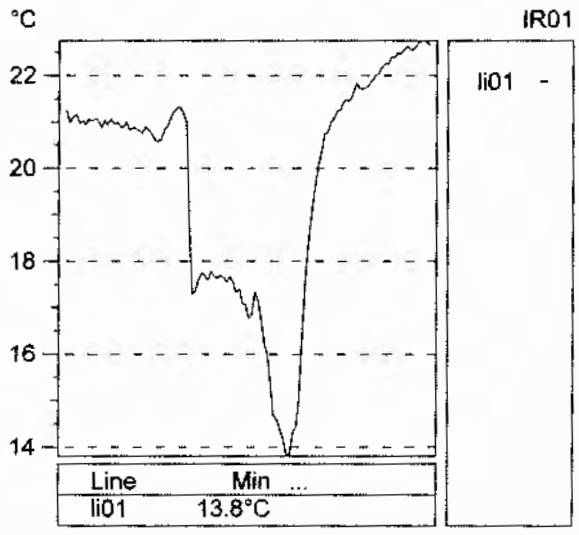
Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	29.8°C	-
IR : min	-2.2°C	-
LI01 : max	21.3°C	0.9°C
LI01 : min	0.3°C	-20.1°C
LI01 : max-min	21.0°C	-
AR01 : max	23.6°C	3.2°C
AR01 : min	-2.2°C	-22.6°C
AR01 : max-min	25.9°C	-
AR01 : avg	13.7°C	-6.7°C

File name	Time	Date
C0315-08.img	2:38:36 PM	3/15/2002



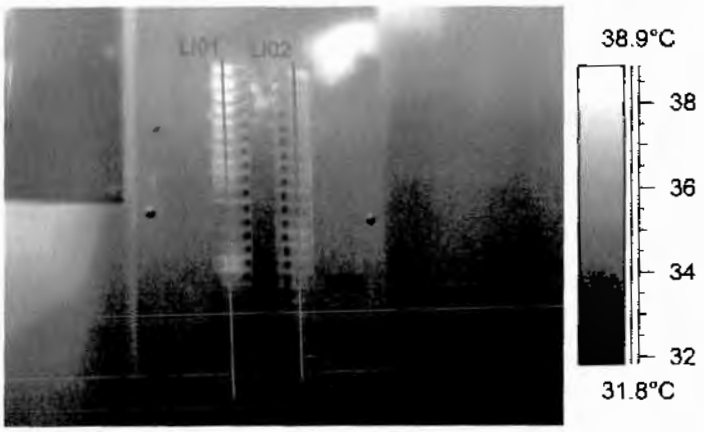


IR Text Comment	Value
Section	Boiler Room Bar
Equipment	Northern Nook Radiation at Wall / Floor
Additional information	
Fault	Elevated heat loss through wall / floor area.
Recommendation	Exterior retrofit.

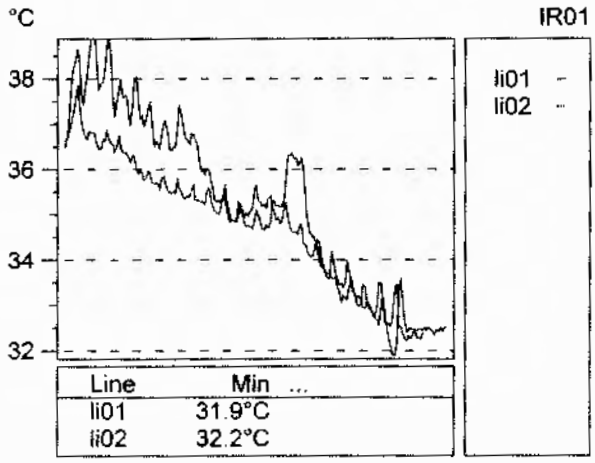


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	33.3°C	-
IR : min	10.9°C	-
LI01 : max	22.8°C	2.4°C
LI01 : min	13.8°C	-6.6°C
LI01 : max-min	9.0°C	-
AR01 : max	22.8°C	2.4°C
AR01 : min	10.9°C	-9.5°C
AR01 : max-min	11.9°C	-
AR01 : avg	18.9°C	-1.5°C

File name	Time	Date
C0315-10.img	2:57:23 PM	3/15/2002

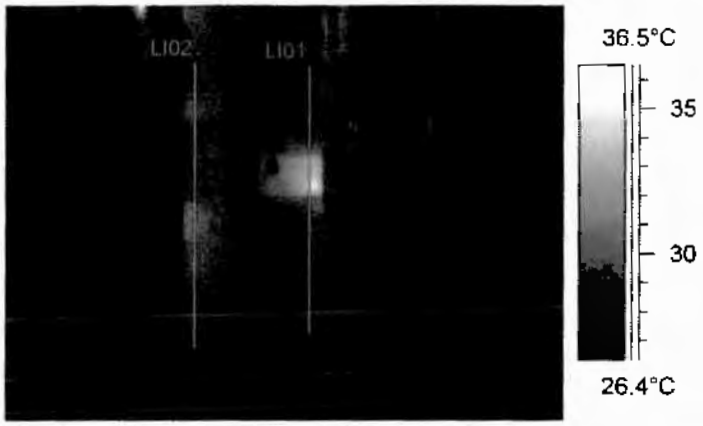


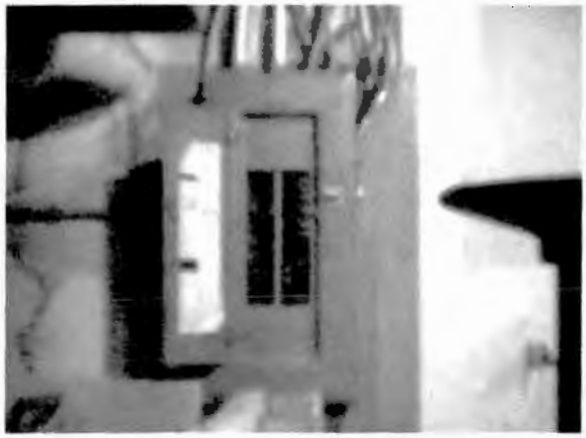
IR Text Comment	Value
Section	Hall Behind Boiler Room
Equipment	Breaker Panel
Additional information	
Fault	Hot Circuit Breaker
Recommendation	Upgrade breaker or reduce load.



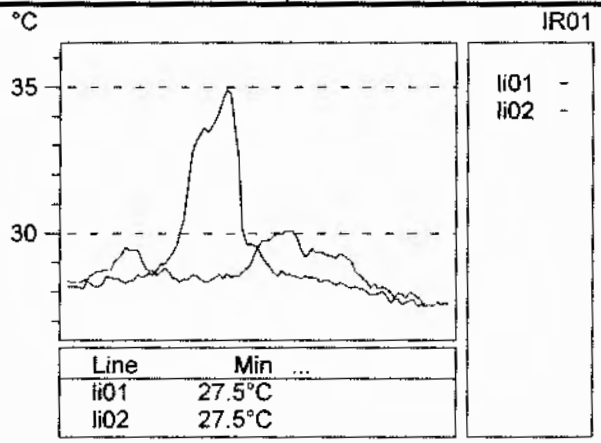
Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	39.3°C	-
IR : min	30.3°C	-
LI01 : max	39.3°C	18.9°C
LI01 : min	31.9°C	11.5°C
LI01 : max-min	7.4°C	-
LI02 : max	37.8°C	17.4°C
LI02 : min	32.2°C	11.8°C
LI02 : max-min	5.6°C	-

File name	Time	Date
C0315-12.img	3:31:58 PM	3/15/2002



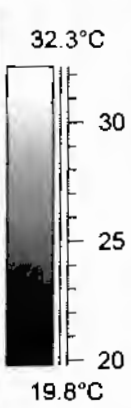


IR Text Comment	Value
Section	Boiler Room Panel
Equipment	Breaker Panel B
Additional information	
Fault	220 V 20 Amp (Freezer)
Recommendation	Increase breaker capacity or reduce load

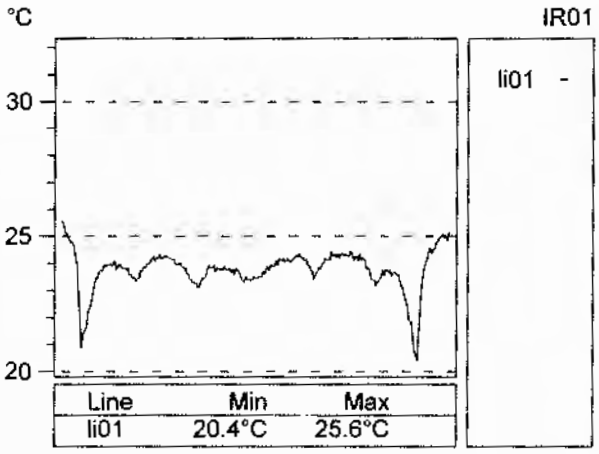


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	46.1°C	-
IR : min	24.7°C	-
LI01 : max	34.9°C	14.5°C
LI01 : min	27.5°C	7.1°C
LI01 : max-min	7.4°C	-
LI02 : max	30.1°C	9.7°C
LI02 : min	27.5°C	7.1°C
LI02 : max-min	2.6°C	-

File name	Time	Date
C0315-18.img	4:15:30 PM	3/15/2002



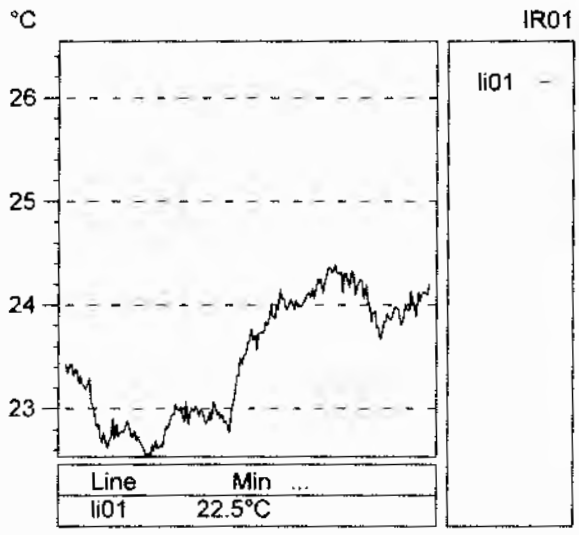
IR Text Comment	Value
Section	Sports Bar
Equipment	Exterior Wall and Beam Pocket
Additional information	
Fault	Poorly installed insulation and air leakage at beam pocket.
Recommendation	Caulk and air seal beam pocket and perform exterior retrofit.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	37.8°C	-
IR : min	18.9°C	-
LI01 : max	25.6°C	5.2°C
LI01 : min	20.4°C	0.0°C
LI01 : max-min	5.1°C	-

File name	Time	Date
C0315-22.img	4:16:47 PM	3/15/2002

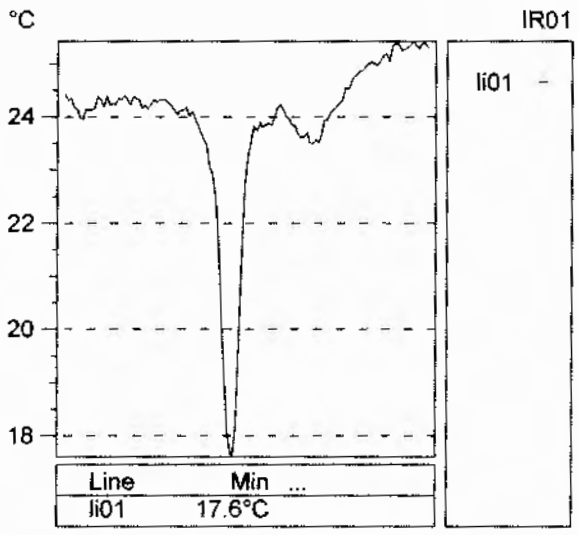
IR Text Comment	Value
Section	Sports Bar
Equipment	Ceiling Support Beam
Additional information	
Fault	Air leakage at ceiling beam
Recommendation	Air seal beam to sealing joint.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	26.2°C	-
IR : min	22.4°C	-
LI01 : max	24.4°C	4.0°C
LI01 : min	22.5°C	2.1°C
LI01 : max-min	1.9°C	-

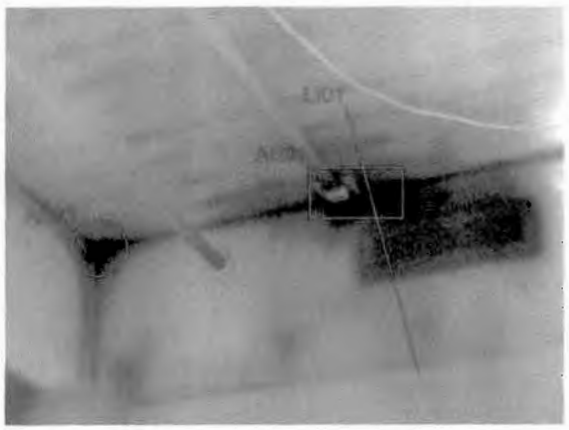
File name	Time	Date
C0315-24.img	4:19:13 PM	3/15/2002

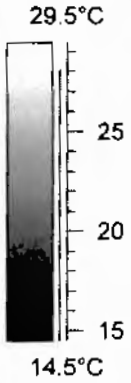
IR Text Comment	Value
Section	Sports Bar
Equipment	Ceiling
Additional information	
Fault	Insulation Flaw in Ceiling
Recommendation	Retrofit ceiling on exterior.

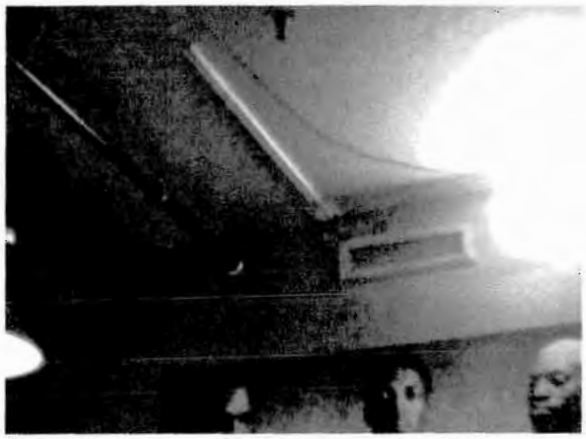


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	69.3°C	-
IR : min	17.5°C	-
LI01 : max	25.4°C	5.0°C
LI01 : min	17.6°C	-2.8°C
LI01 : max-min	7.8°C	-
AR01 : max	24.7°C	4.3°C
AR01 : min	17.5°C	-2.9°C
AR01 : max-min	7.2°C	-
AR01 : avg	23.3°C	2.9°C
AR02 : max	25.4°C	5.0°C
AR02 : min	20.0°C	-0.4°C
AR02 : max-min	5.4°C	-
AR02 : avg	23.2°C	2.9°C

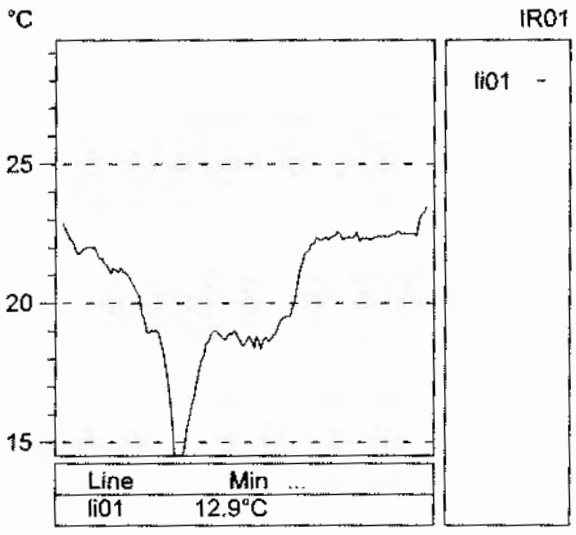
File name	Time	Date
C0315-26.img	4:19:57 PM	3/15/2002







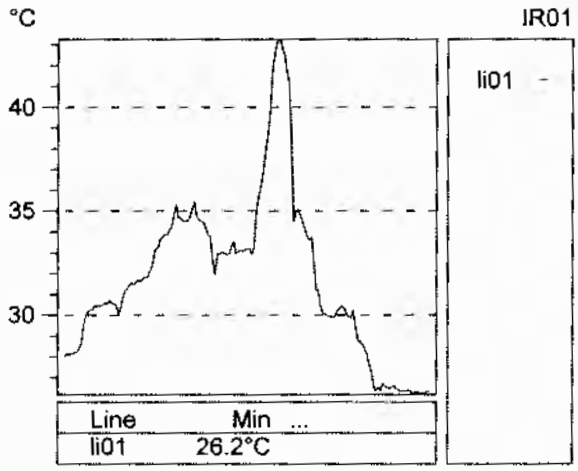
IR Text Comment	Value
Section	Sports Bar
Equipment	Ceiling / Wall Joint
Additional information	
Fault	Poorly installed insulation and air leakage.
Recommendation	Retrofit ceiling on exterior.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	28.5°C	-
IR : min	11.6°C	-
LI01 : max	23.5°C	3.1°C
LI01 : min	12.9°C	-7.5°C
LI01 : max-min	10.6°C	-
AR01 : max	23.0°C	2.6°C
AR01 : min	11.6°C	-8.8°C
AR01 : max-min	11.5°C	-
AR01 : avg	17.8°C	-2.5°C
AR02 : max	21.3°C	0.9°C
AR02 : min	13.9°C	-6.4°C
AR02 : max-min	7.3°C	-
AR02 : avg	18.9°C	-1.5°C

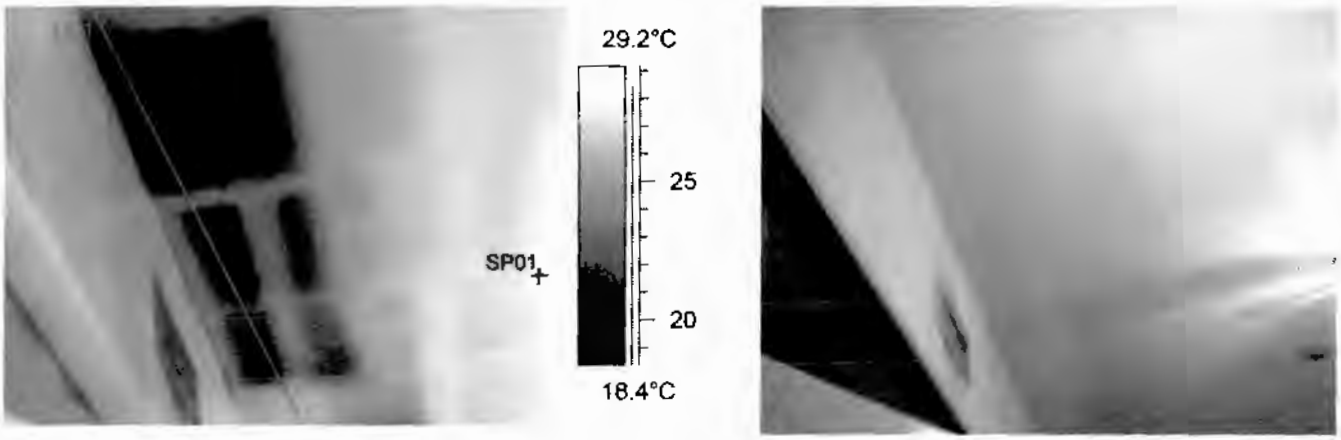
File name	Time	Date
C0315-28.img	4:25:07 PM	3/15/2002

IR Text Comment	Value
Section	Yukon Inn Restaurant
Equipment	Kitchen Breaker Panel R
Additional information	
Fault	Hot Breaker
Recommendation	Replace breaker or reduce load.

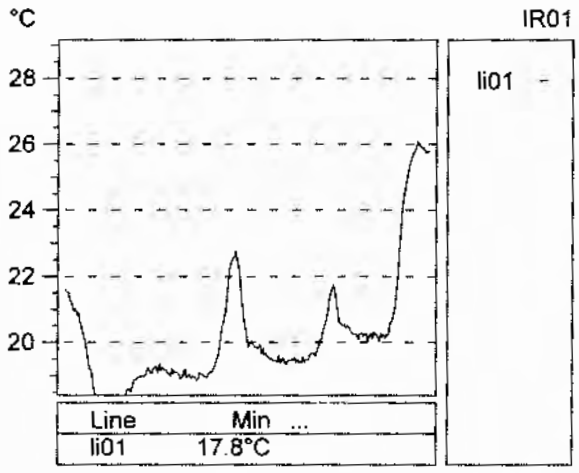


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	44.1°C	-
IR : min	23.9°C	-
LI01 : max	43.3°C	22.9°C
LI01 : min	26.2°C	5.8°C
LI01 : max-min	17.1°C	-

File name	Time	Date
C0315-30.img	4:28:54 PM	3/15/2002

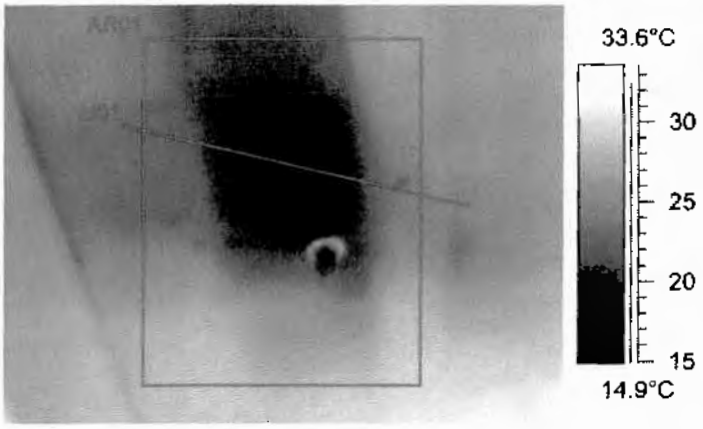


IR Text Comment	Value
Section	Kitchen
Equipment	Staff area ceiling at ventilation grille
Additional information	
Fault	Missing/wet or poorly installed insulation in ceiling.
Recommendation	Perform exterior roof retrofit.

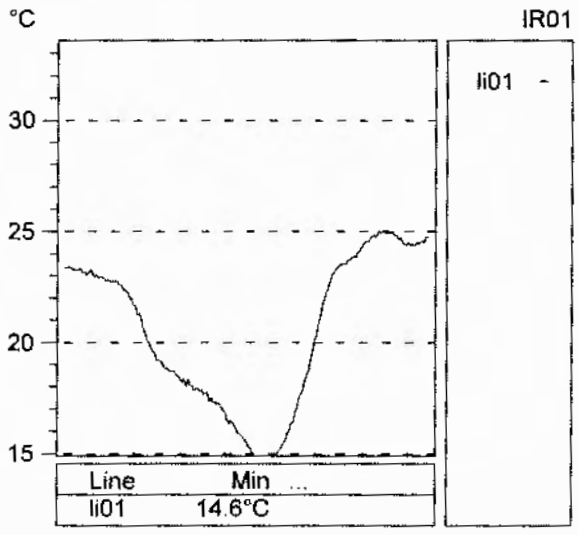


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	28.6°C	-
IR : min	17.3°C	-
SP01	28.0°C	7.6°C
LI01 : max	26.1°C	5.7°C
LI01 : min	17.8°C	-2.6°C
LI01 : max-min	8.3°C	-

File name	Time	Date
C0315-32.img	4:30:27 PM	3/15/2002



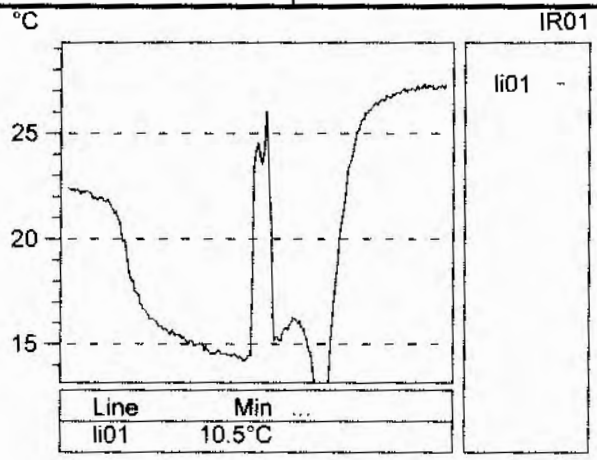
IR Text Comment	Value
Section	Kitchen
Equipment	Staff Table Area Ceilingat Sprinkler Head
Additional information	
Fault	Missing/wet or poorly installed insulation.
Recommendation	Perform exterior ceiling/roof retrofit.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	32.5°C	-
IR : min	14.2°C	-
LI01 : max	25.0°C	4.6°C
LI01 : min	14.6°C	-5.8°C
LI01 : max-min	10.4°C	-
AR01 : max	30.2°C	9.8°C
AR01 : min	14.2°C	-6.2°C
AR01 : max-min	16.0°C	-
AR01 : avg	22.9°C	2.5°C

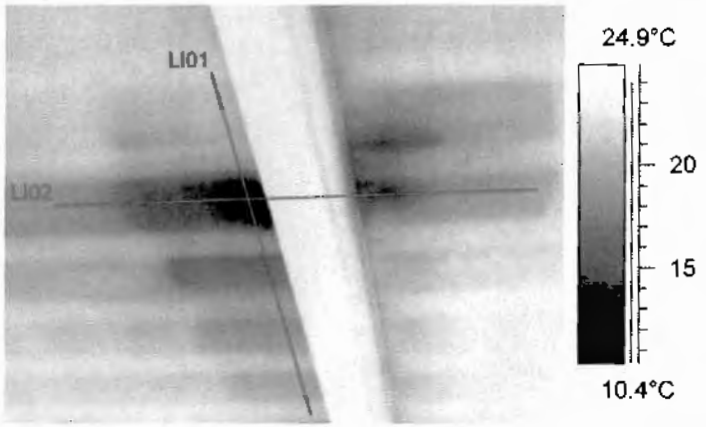
File name	Time	Date
C0315-36.img	4:35:33 PM	3/15/2002

IR Text Comment	Value
Section	Kitchen
Equipment	Side Entry Ceiling
Additional information	
Fault	Missing/wet or poorly installed insulation.
Recommendation	This area has signs of damage. Perform exterior retrofit.

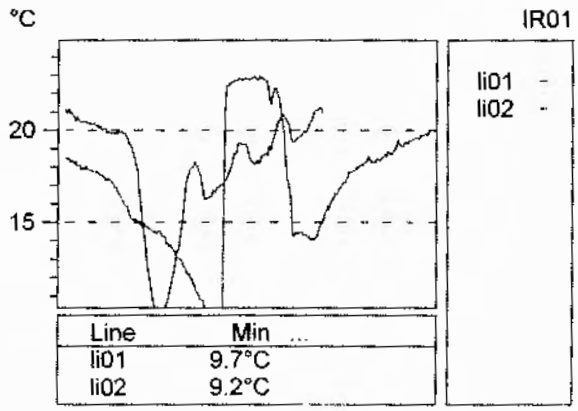


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	29.0°C	-
IR : min	10.1°C	-
LI01 : max	27.3°C	6.9°C
LI01 : min	10.5°C	-9.8°C
LI01 : max-min	16.8°C	-
AR01 : max	21.9°C	1.5°C
AR01 : min	10.1°C	-10.3°C
AR01 : max-min	11.8°C	-
AR01 : avg	18.3°C	-2.1°C

File name	Time	Date
C0315-38.img	4:37:38 PM	3/15/2002

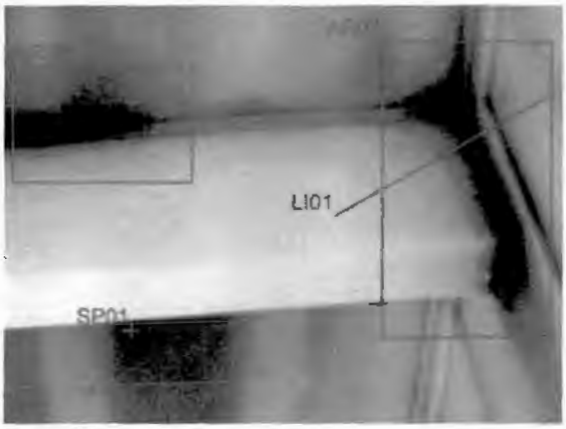


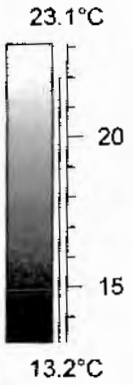
IR Text Comment	Value
Section	Dining Room
Equipment	3rd Ceiling/Beam Looking at Register
Additional information	
Fault	Poorly installed/damaged ceiling insulation.
Recommendation	Perform ceiling/roof retrofit.



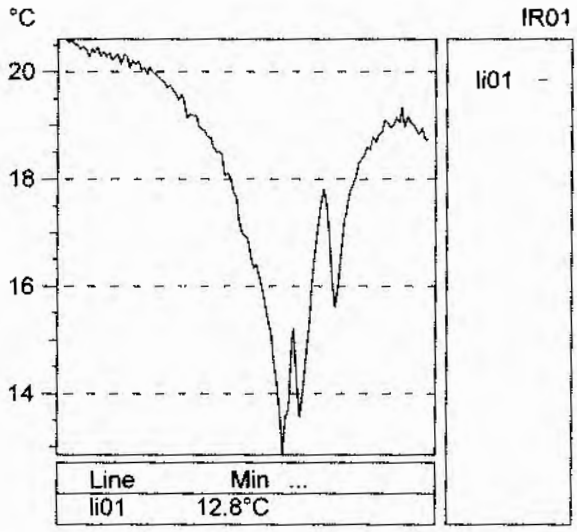
Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	24.3°C	-
IR : min	9.1°C	-
LI01 : max	21.3°C	0.9°C
LI01 : min	9.7°C	-10.7°C
LI01 : max-min	11.6°C	-
LI02 : max	22.9°C	2.5°C
LI02 : min	9.2°C	-11.2°C
LI02 : max-min	13.7°C	-

File name	Time	Date
C0315-42.img	4:44:40 PM	3/15/2002





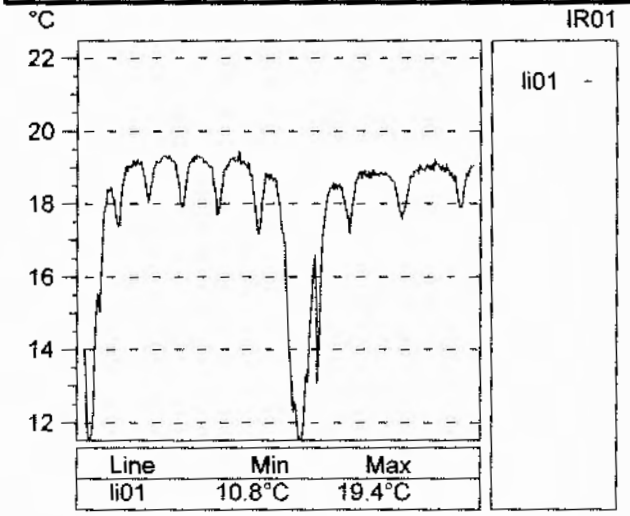
IR Text Comment	Value
Section	Dining Room
Equipment	Beam Pocket at Fourth Beam
Additional information	
Fault	Air leakage and poorly installed insulation
Recommendation	Perform exterior retrofit.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	22.1°C	-
IR : min	6.5°C	-
SP01	14.3°C	-6.1°C
LI01 : max	20.6°C	0.2°C
LI01 : min	12.8°C	-7.5°C
LI01 : max-min	7.8°C	-
AR01 : max	20.9°C	0.5°C
AR01 : min	6.5°C	-13.9°C
AR01 : max-min	14.4°C	-
AR01 : avg	17.5°C	-2.9°C
AR02 : max	20.5°C	0.1°C
AR02 : min	8.9°C	-11.5°C
AR02 : max-min	11.6°C	-
AR02 : avg	16.8°C	-3.6°C

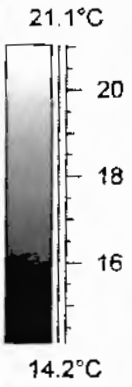
File name	Time	Date
C0315-44.img	4:46:22 PM	3/15/2002

IR Text Comment	Value
Section	Coyote Room
Equipment	Wall/Header Above Windows
Additional information	
Fault	Air leakage and poorly installed insulation
Recommendation	Perform exterior retrofit.

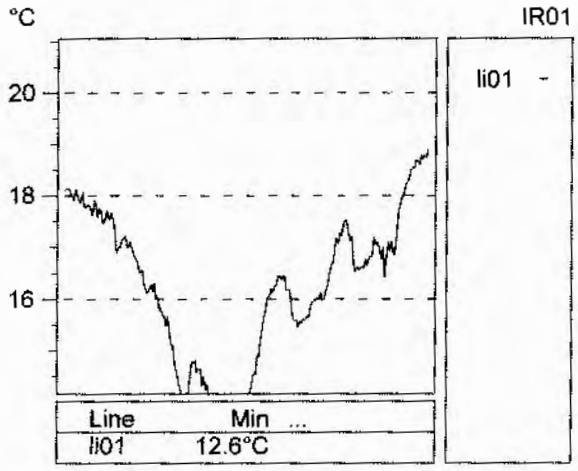


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	111.6°C	-
IR : min	5.9°C	-
LI01 : max	19.4°C	-1.0°C
LI01 : min	10.8°C	-9.6°C
LI01 : max-min	8.6°C	-

File name	Time	Date
C0315-46.img	4:47:26 PM	3/15/2002

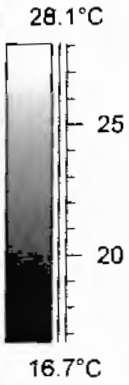


IR Text Comment	Value
Section	Coyote Room
Equipment	Ceiling/Beam
Additional information	
Fault	Damaged or poorly installed insulation above beam
Recommendation	Perform exterior retrofit.

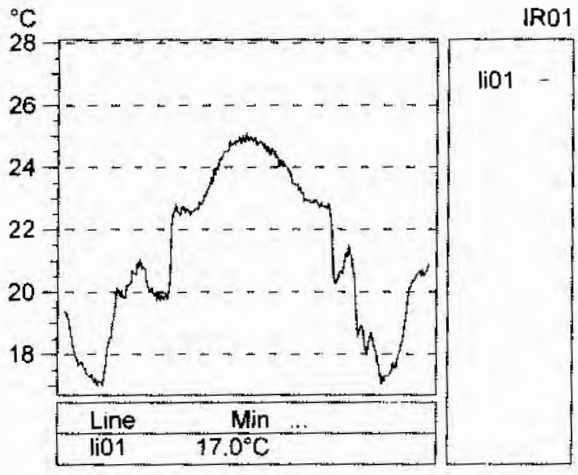


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	22.9°C	-
IR : min	12.3°C	-
LI01 : max	18.9°C	-1.5°C
LI01 : min	12.6°C	-7.8°C
LI01 : max-min	6.3°C	-

File name	Time	Date
C0315-48.img	5:45:56 PM	3/15/2002



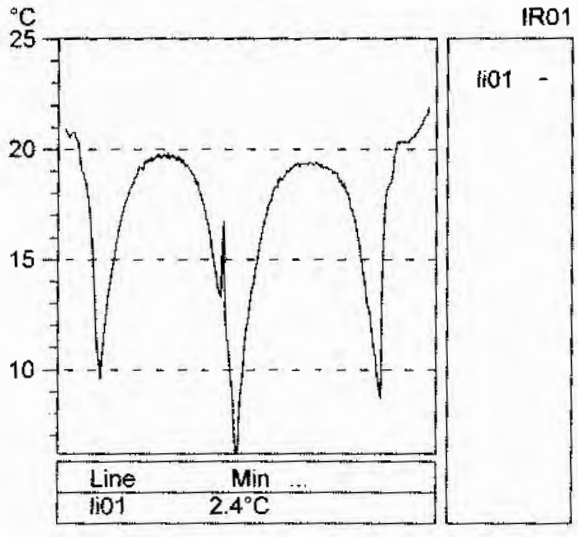
IR Text Comment	Value
Section	Banquet Room
Equipment	Fireplace Wall
Additional information	
Fault	AirLeakage around fireplace
Recommendation	Air seal all cracks and joints and perform exterior retrofit.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	49.9°C	-
IR : min	11.6°C	-
SP01	15.6°C	-4.7°C
LI01 : max	25.1°C	4.7°C
LI01 : min	17.0°C	-3.4°C
LI01 : max-min	8.1°C	-
AR01 : max	49.9°C	29.5°C
AR01 : min	15.0°C	-5.4°C
AR01 : max-min	34.8°C	-
AR01 : avg	21.0°C	0.6°C

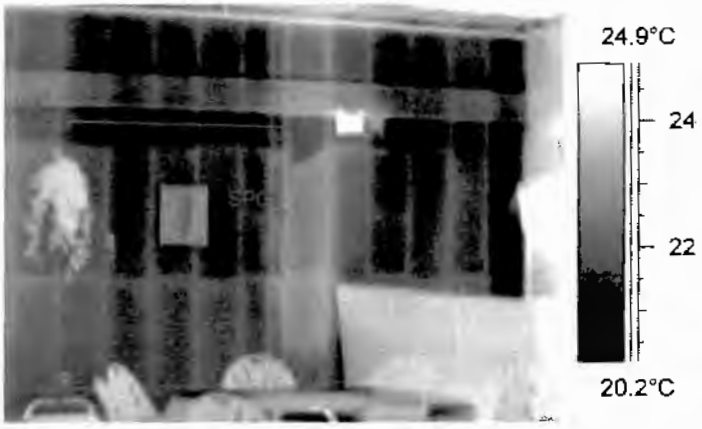
File name	Time	Date
C0315-52.img	5:47:26 PM	3/15/2002

IR Text Comment	Value
Section	Banquet Room
Equipment	Exterior Exit Doors
Additional information	
Fault	Air leakage around door perimeters
Recommendation	Install/adjust weatherstripping.

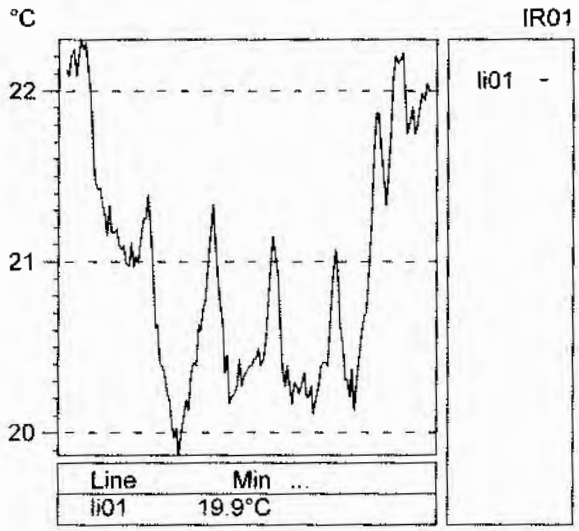


Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	31.6°C	-
IR : min	1.5°C	-
LI01 : max	21.9°C	1.5°C
LI01 : min	2.4°C	-18.0°C
LI01 : max-min	19.5°C	-

File name	Time	Date
C0315-54.img	5:49:43 PM	3/15/2002



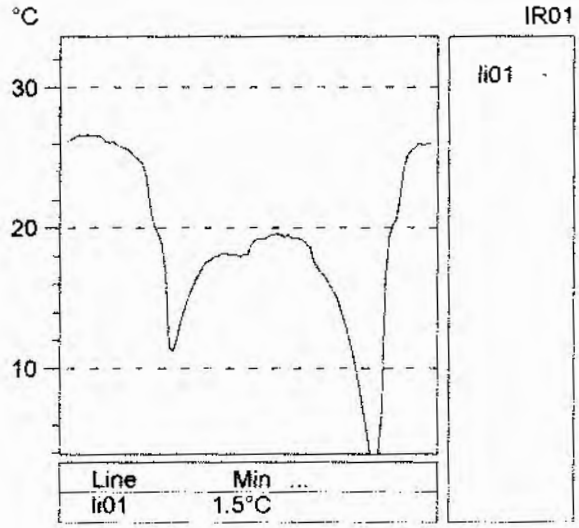
IR Text Comment	Value
Section	Banquet Room
Equipment	Exterior Wall
Additional information	
Fault	Poorly installed insulation
Recommendation	Perform Exterior Retrofit



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	32.3°C	-
IR : min	19.3°C	-
SP01	22.6°C	2.2°C
LI01 : max	22.3°C	1.9°C
LI01 : min	19.9°C	-0.5°C
LI01 : max-min	2.4°C	-

File name	Time	Date
C0315-60.img	5:52:05 PM	3/15/2002

IR Text Comment	Value
Section	Hallway Exit
Equipment	Exterior Door
Additional information	
Fault	Air leakage around door
Recommendation	Adjust or replace weatherstripping.



Object parameter	Value	
Emissivity	0.90	-
Object distance	3.3 m	-
Ambient temperature	15.0°C	-
Reference temperature	20.4°C	-
Label	**Value**	**Diff temperature**
IR : max	83.0°C	-
IR : min	-4.6°C	-
SP01	17.9°C	-2.5°C
LI01 : max	26.6°C	6.2°C
LI01 : min	1.5°C	-18.9°C
LI01 : max-min	25.1°C	-

Summary of survey

Section	Equipment	Fault	Recommendation
Boiler Room Bar	Radiant Panel and Windows	Heat from panel is lost through double pane windows and wall	Insulate exterior of basement wall and install triple pane glas
Boiler Room Bar	View of exterior wall and windows	Heat loss through windows	Insulate exterior of basement wall and install triple pane glas
Boiler Room Bar	Northern Nook and Exterior Door	High heat loss from air leakage around door	Install tight fitting weatherstripping around doors.
Boiler Room Bar	Northern Nook Radiation at Wall / Floor	Elevated heat loss through wall / floor area	Exterior retrofit.
Hall Behind Boiler Room	Breaker Panel	Hot Circuit Breaker	Upgrade breaker or reduce load.
Boiler Room Panel	Breaker Panel B	220 V 20 Amp (Freezer)	Increase breaker capacity or reduce load.
Sports Bar	Exterior Wall and Beam Pocket	Poorly installed insulation and air leakage at beam pocket.	Caulk and air seal beam pocket and perform exterior retrofit.
Sports Bar	Ceiling Support Beam	Air Leakage at ceiling beam	Air seal beam to sealing joint.
Sports Bar	Ceiling	Insulation Flaw in Ceiling	Retrofit ceiling on exterior.
Sports Bar	Ceiling / Wall Joint	Poorly installed insulation and air leakage.	Retrofit ceiling on exterior.
Yukon Inn Restaurant	Kitchen Breaker Panel R	Hot Breaker	Replace breaker or reduce load.
Kitchen	Staff area ceiling at ventilation grille	Missing/wet or poorly installed insulation in ceiling	Perform exterior roof retrofit.
Kitchen	Staff Table Area Ceilingat Sprinkler Head	Missing/wet or poorly installed insulation	Perform exterior ceiling/roof retrofit.
Kitchen	Side Entry Ceiling	Missing/wet or poorly installed insulation	This area has signs of damage. Perform exterior retrofit.
Dining Room	3rd Ceiling/Beam Looking at Register	Poorly installed/damaged ceiling insulation	Perform ceiling/roof retrofit.
Dining Room	Beam Pocket at Fourth Beam	Air leakage and poorly installed insulation	Perform exterior retrofit.
Coyote Room	Wall/Header Above Windows	Air leakage and poorly installed insulation	Perform exterior retrofit.
Coyote Room	Ceiling/Beam	Damaged or poorly installed insulation above beam	Perform exterior retrofit.
Banquet Room	Fireplace Wall	AirLeakage around fireplace	Air seal all cracks and joints and perform exterior retrofit.
Banquet Room	Exterior Exit Doors	Air leakage around door perimeters	Install/adjust weatherstripping.
Banquet Room	Exterior Wall	Poorly installed insulation	Perform Exterior Retrofit
Hallway Exit	Exterior Door	Air leakage around door	Adjust or replace weatherstripping.