

ENERGY ANALYSIS OF MILE 1202 MOTOR INN - BEAVER CREEK, CANADA



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EXECUTIVE SUMMARY

The following document represents a cursory view of the way energy is used in five buildings located at Beaver Creek, Canada. Because extensive fuel use records were unavailable and three energy sources were used at multiple sites, analysis of past energy use was not attempted. Instead, documented energy use was extrapolated to approximate a one year cost example for the complex.

~~Additional buildings used by the owners were not audited.~~ A house and residence are located at a different site in Beaver Creek. If conditions found at the Motor Inn are representative, it is assured that these buildings would also benefit from a similar audit. Four of the five Motor Inn buildings have been grouped into one set of recommendations as only the log Lodge greatly differs in construction type with the others being modular. The audit was a complex one as all systems were found to be in need of extensive thermal, air sealing and mechanical upgrades.

Details outlining specific modifications were avoided as, in most cases, multiple paths exist to achieve similar results. Due to the age of the modular outbuildings and potential cost for upgrading the building envelopes it was felt that such an extensive project might not be undertaken. I have provided a narrative describing considerations taken in selecting the paths outlined and recommend that further design schematics be obtained prior to pursuing any work noted within this report.

Dangerous conditions such as an overloaded circuit found in the Lodge basement and the water heater and furnace backdrafting in Building B were documented and recommendations have been made to alleviate the threats. Switching fuels from propane to oil, and from furnaces to boilers, will offer the most rapid payback and minimize the danger of backdrafting.

Solar preheating of domestic hot water will greatly reduce summer fuel use, especially if conservation efforts are in place. Hot water conservation will alter the necessary size of the solar system and I deferred specifics on this to others having more experience with solar design.

Overall, this report represents a photo essay of the ongoing struggle of a private sector service provider in the Yukon Territory. The project is in great need of being organized and cleaned up before these energy improvement options are applied but it is possible to maximize profit and comfort through application of such recommendations.

Success resides in follow-through by the Owners.

REPORT NARRATIVE

MAIN LODGE:

Log buildings embody the frontier spirit like no other building style. Carving a spot from the wilderness and constructing a shell that will protect us from the elements is the dream of many and is often commercially desirable for maintaining a rustic appearance. The 1202 Motor Inn is such a building.

~~Constructed of natural log the building is large and sprawling with memorabilia spread along the walls reminiscent of an earlier time. From the energy use perspective the building is expensive to operate as heat and air leak from every joint, corner and checked log. During my audit I was able to secure numerous infrared thermagrams illustrating this energy loss. Please see the IR attachments in Appendix C for these images.~~

Improving building energy use is made more difficult if the rustic log appearance is to be maintained, however, several options exist for doing this. Accepting that the 'look' provided by the log walls is to remain intact eliminates other proven weatherization approaches. Selecting one of three areas to apply weatherization techniques is available: exterior improvements, interior improvements and a combination of both. I am recommending that both sides of the walls be slightly modified so as to provide the maximum benefit for the owners.

In the Beaver Creak climate zone and with their related high energy costs it only makes sense to reduce overhead as much as possible so that maximum profits may be realized. Present building performance requires that one must sell a lot of hamburgers in order to simply pay the heating bill.

LOG WALLS:

Application of products manufactured by Weatherall will greatly improve comfort and reduce energy use in this building. The Weatherall products for log walls consist of 1) a triangular expanded polyethylene backer rod and 2) a durable and flexible sealant that is applied over the installed backer rod. The sealant is available in many colors so as to closely match the log walls.

We have previously used roofing nails to fasten the triangular backer rod into the joints between log rounds. Using large head roofing nails provided the best support. After application of backer rod we used a "Hose Monster" TM to spread the sealant into place where we then troweled it to a smooth and flat finish. This material may also be gunned on with special applicators available from the manufacturer. It is important to use a release agent created by mixing alcohol and water, which is then sprayed onto the trowel and caulk to prevent the caulk from sticking to the trowel. The release agent also provides a smooth, neat finish.

Preparation is most important for products to properly adhere to wood surfaces over time. Washing and then lightly abrading the log joint surfaces using a wire brush or 3M Scotch-Brite pad fixed to a grinder works well to scour away any accumulation of dust and dirt. I have personally directed applications in the use of Weatherall products to over one hundred log buildings. Where applied properly, all buildings demonstrated great success in reduced air leakage and energy use.

Call Weatherall Northwest at 1-800-531-2286 for more information
Product literature is located in Appendix D.

ROOF/CEILING:

While log walls may be the least airtight building component, the second floor ceiling/roof area is where a constant pressure driven air flow is exerted greatest during winter months. The lodge roof was covered at the eaves with glaciers and bare areas shown through the snow cover in many areas, indicative of localized heat loss. (See photos, Appendix A)

I recommend application of a new ceiling installed from inside to combat the air leakage and poor thermal properties of the existing roof. Using rigid foam insulation nailed directly to the existing surfaces will provide the best coverage at a minimal expense and dimensional loss. A foil faced polyisocyanurate insulation such as Thermax or R-Max will work well as the foil is a perfect air/vapor retarder and only seam and edge sealing will be necessary to accomplish a very airtight installation. The addition of insulation beneath rafters will serve as a thermal break and further reduce heat loss and associated exterior snow melt, glaciating, etc.

If lowering the ceiling is not a concern then furring down and using fiberglass insulation will also suffice. After installing insulation the application of an airtight air/vapor retarder will be critical. Using Tremco Acoustical Sealant to provide the air seal and a tape such as 3M 8086 Red contractor's tape or staples as the mechanical fastener works well for sealing joints between logs to ceiling and edges of polyethylene.

Alternative to installation of additional insulation and a continuous air/vapor retarder, extensive air sealing may be used to limit air leakage through the roof component. A large fan should be used to identify the exact leak location with application of appropriate sealants and tapes being used to seal all identifiable leakage areas. This approach will not be as easy to accomplish as it sounds, however, and my first recommendation is for the installation of rigid foam as noted above.

CRAWLSPACE FOUNDATION:

The crawlspace for the building is nothing short of a disaster. There is no ground air/vapor barrier and the walls are only partially insulated and not air sealed in addition to the space being cluttered and dirty. A wood floor in one half of the space has been constructed of boards with large gaps in between with the other half of the building being comprised of exposed dirt and soil. Heating systems are not easily accessed and old parts and discarded ducts, wires, etc. are scattered about. Gutting the floor and removing all debris will be necessary prior to beginning work in improving energy efficiency.

After the area has been emptied of debris the crawlspace walls should be stripped of all poorly installed air/vapor retarder material and the thermal envelope clearly defined. The thermal envelope is that area that separates the heated, conditioned space from the outside or unheated ground. The idea is to provide a continuous and contiguous envelope comprised of framing, insulation and an air/vapor retarder with all components contacting one another.

Fiberglass insulation must be installed perfectly for it to perform as designed and tested. In many places such insulation is packed into the cavity without completely filling it, or equally as bad, it does not fill the space. It is most important that the insulation fully fill the cavity above and below grade and currently, many areas below grade have no insulation installed. After filling all cavities with insulation and making sure the loft and coverage is complete the walls should be covered completely with a polyethylene air/vapor retarder. This material must be sealed to the concrete footer and at the top and bottom plates using Tremco Acoustical Sealant and then stapled to the respective plate through the bead of Tremco. All laps and joints in the polyethylene should be made on studs and plates so that solid backing will be available when the interior covering is applied. No holes or air leaks can be allowed. Application of a fire retardant interior covering must then be applied so as to protect the polyethylene sheeting from damage.

RIM JOIST:

Constructing the rim joist in a thermally efficient manner is not so difficult as it may seem. Using fiberglass insulation to completely fill the cavity is the first step. Next, use a block of rigid foil faced insulation (Rmax/Thermax) cut to fit precisely between floor joists, top plate of the crawl wall and the underside of the floor above. Install this block of rigid insulation into the rim joist space so that it slightly compresses the previously installed fiberglass insulation and then caulk the perimeter crack using Tremco Acoustical Sealant. Place a cover of 3M 8086 Red contractors' tape over the Tremco bead to prevent accidental movement of the sealant.

Where running with the length of the joists, at the end wall, the entire first floor joist cavity should be filled with fiberglass and the space below covered with rigid foam insulation and air sealed as noted above.

CRAWL FLOOR:

Remove the existing wood flooring and install a continuous polyethylene air/vapor retarder so as to completely cover the crawlspace floor. No area should be left exposed. Seal all laps, joints and perimeter connections using Tremco Acoustical Sealant.

For a space of four feet around the perimeter of the entire crawlspace floor install a minimum of two inches of Dow SM rigid insulation. Laying the insulation directly on the ground is adequate but covering the product in areas of frequent traffic will be necessary. Install a new floor over the floor insulation and air/vapor retarder making it tight so as to prevent damage to the air/sealing and insulation materials.

MOTEL BUILDINGS:

The following modifications pertain to each of the four outbuildings, A, B, C and D. These modular buildings are manufactured units and have very similar construction characteristics. The exterior walls are of 2x4 frame covered on the outside with metal siding. Wood paneling has been applied to the exterior of the buildings with building D being sided in wood planks. The overall condition of these structures is fair with normal wear and tear showing from years of service. Each building has a metal frame below supported on post and pad foundation. They are all fairly level and show little signs of settling.

Rooms are small due to their narrow width, required to make them easy to transport. Because of this small interior space it will be necessary to approach an effective retrofit from the exterior as reducing their interior size would also reduce functionality. This makes for a simplified approach in attempting to improve energy performance and extend the useful life of the buildings.

The buildings appear to be structurally sound. Hot and cold running water is available into each room making it necessary to maintain relatively warm winter interior temperatures, occupied or not. This results in elevated energy expenses whether or not an adequate revenue flow is present. I stayed in one room in building B (unit #24) during my observation period while the exterior temperature was hovering -30 C. I found numerous deficiencies and documented most of them in my infrared survey report, located in Appendix C.

The Motel buildings suffer from four primary defects:

- 1, Elevated Air Leakage
- 2, Poorly Installed Insulation
- 3, Inadequate Levels of Insulation
- 4, Inappropriate and inefficient heating systems

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1202 MOTOR INN - MOTEL ROOMS

1. AIR LEAKAGE

These modular units were constructed before our awareness of the importance of air leakage was known. During performance of air-tightness testing I found copious quantities of air moving freely between units and the outdoors. Only two realistic options exist for air sealing these buildings... Exterior air barrier wrap or Search and Seal.

Exterior air/vapor barrier wrap: this option provides for a very complete and continuous air/vapor retarder. It is the preferred method for older building remodeling as it is simple to visually validate coverage. There are only a few steps necessary to accomplish a very tight structure.

- a. Remove all exterior roofing, siding and trim that may be re-used.
- b. Wrap the exterior with polyethylene sheeting
- c. Seal all laps and joints with Tremco Acoustical Sealant
- d. Install exterior insulation façade detailing windows, doors and mechanical penetrations
- e. Reinstall roofing, trim and siding, if usable.

The “Search and Seal” approach is not as easy or as affective as the exterior wrap due to the great complexity of randomly located leakage areas. Various aspects of interior applied airsealing make this approach less attractive.

1. The units are currently in operation and closing them for such work will reduce income adding further burden to the economic viability of the project.
2. Air leakage at the interior is extremely difficult to perform without first gutting the building.
3. Interior surfaces are more expensive to replace.
4. Chasing leaks is the result of sealing a few. If all are not found and sealed the reduction is not significant.
5. Visual affects of interior applied air sealing efforts are not always pleasing or acceptable.
6. Tools and materials are not easily supplied in remote locations.

Details for either approach may be provided at a future date.

2. POORLY INSTALLED INSULATION

Our thermal imaging indicated numerous flaws in the way the insulation had been installed into all building cavities during construction. The only way to receive the full benefit of the manufacturers claimed R-value is to have it installed as it was tested at the laboratory. Unfortunately, correcting this deficiency is most difficult, after the fact.

Removal of all interior or exterior surfaces must be achieved in order to access the areas in question. If additional measures are being undertaken at the same time, such as a total interior gut or exterior siding removal, then the successful correction of insulation deficiencies is easier to accomplish.

The most reasonable approach for these buildings is to leave alone those cavities which cannot be exposed in the process and install additional insulation outside the air/vapor barrier. Doing this requires an understanding of the rules for air/vapor barrier placement. Physics of moisture transport mechanisms require an insulated building component to have an air/vapor barrier located no further than one third of the way into the total R-value. This is most important in the interest of reducing maintenance costs, maintaining the health of occupants, and long term structural integrity.

3. INADEQUATE LEVELS OF INSULATION

R-11 is sub-standard for the severe Beaver Creek winter climate. Economics indicate a minimum level of R-21 be used in wall assemblies. Since these structures were built with only 2x4 walls and limited access to roof/ceiling cavities the application of additional insulation would require a curtain wall/roof approach. A curtain wall is simply described as: a new wall is constructed outside the existing wall that has been designed to contain at least twice the original wall R-value (1/3-2/3s Rule). The same approach is used to improve R-values in roofs of buildings and trailers with inaccessible flat roofs.

Such a retrofit might include the following steps:

1. Remove roof and install complete polyethylene air/vapor retarder.
2. Construct new roof, extending bottom chord over the wall far enough to receive new exterior curtain wall and provide adequate overhang, typically eighteen inches.
3. Wrap walls with polyethylene sheeting, air sealing all laps and joints using Tremco.
4. Install ledger around exterior perimeter of walls to support curtain wall.
5. Install curtain wall framing on 24" centers around perimeter.
6. Wrap window and door rough openings and move existing units to curtain wall.
7. Completely fill curtain wall with an appropriate level of insulation (a minimum of twice the original). In a motel with 2x4 existing walls, located in the Beaver Creek climate area, this would be R-21 placed into a 2x6 curtain wall.
8. Install weather barrier such as Tyvek or Barricade.
9. Install siding and trim.
10. Install insulation into attic space appropriate to climate area, a minimum R-38 for Beaver Creek.

This option has frequently been used successfully in Alaska with the additional benefit of greatly extending the useful life of the building.

4. INAPPROPRIATE AND INEFFICIENT HEATING SYSTEMS

I placed the inappropriate aspect of the heating systems ahead of being inefficient due to their misapplication. I am saying that the use of residential furnaces, installed without complete ducting into a commercial motel is inappropriate. Customers expect to be comfortable and safe when paying for temporary lodging. The furnaces in Buildings B, C, and D are incapable of providing this in their present capacity. While performing this audit I experienced and documented clear signs of combustion appliance Backdrafting (see photos of Building B in Appendix B). The following problems exist with the currently installed furnaces:

1. Backdrafting due to pressure imbalances, e.g., improper return air ducting installed.
2. Inability to zone individual rooms. Switching to hydronic heat distribution would allow individual room temperature control.
3. Uncomfortable noise, dust and combustion flue gas recirculation
4. Inefficient resource utilization. Installed furnaces provide a low 75% AFUE, far lower than acceptable. Efficiencies of up to 87% Annual Fuel Utilization Efficiency is available in modern oil fired boilers.

Switching to an oil-fired boiler heating strategy would provide the following advantages:

1. Provide quiet, clean and efficient heat distribution. Forced air heating is noisy, keeps circulating dust and has higher operating costs.
2. You would reduce operating electrical use. (Large fans cost much more to operate than do small circulating pumps)
3. A district heating strategy would be available. District heating means you can use several small boilers in a remote location to supply heat and hot water to multiple sites. This would mean construction of a 'mechanical building' and then pumping the heated water to the various buildings via a utilidor.
4. Have little affect on building air leakage. Because hot air furnaces must blow and then suck air around the building they have a negative affect on the leakage rate of the building.
5. Oil provides more btus per unit dollar than does propane.
6. Hydronic distribution easily provides individual room temperature control and night setbacks, forced air does not.
7. Minimize or eliminate detrimental effects of combustion appliance Backdrafting.

After spending three nights in room 24 of building B I experienced extremely dry skin, a nosebleed and stuffed up sinuses. Performing a retrofit as described in this

document would likely have prevented these symptoms. In addition, the room was almost always either too hot or too cold with uncomfortable temperature swings between heating cycles.

If you choose to continue with using the current furnace arrangement I strongly suggest you install a CO monitor such as the "Life Monitor" LM-100, combustible gas and carbon monoxide alarm. This will alert occupants to a dangerous situation from backdrafting when it does occur. I have enclosed literature describing the alarm within this report.

REDUCING DOMESTIC HOT WATER DEMAND

Motels and restaurants have very different requirements for hot water. In the interest of lowering hot water use the opportunity to affect reductions in motels is far greater than in restaurants as the shower is the greatest load in a motel environment and dishwashing and food preparation dominates restaurant use.

If room 24 in building B is typical for the motel showers it is easy to expect at least a 50% reduction with installation of low flow showerheads. I measured the flow in room 24 to be almost five gallons per minute. A ten minute shower would use almost fifty gallons of water, over half of it heated. Insulating all domestic water lines, both hot and cold, will also achieve good savings in water use and heating costs.

I have enclosed an article describing such energy saving opportunities within Appendix D.

SOLAR WATER HEATING

Installation of solar water heating panels will provide a good payback, however, it will not allow for twelve-month operation. A combined solar and fossil fueled water system will be necessary as heat from the sun at the northern latitude of Beaver Creek will not be able to make year-round hot water.

Incoming water temperatures were very cold when I was at Beaver Creek and the sun was pretty low on the horizon. This means that the potential for solar in January will be practically non-existent.

An excellent location for mounting such solar collectors would be on the roof of Building A, which houses the motel laundry facility and appears to face almost due south. The roof structural loading ability should be confirmed prior to mounting and such solar collectors.

Loads for motel room hot water use are estimated to average around eighteen liters of 60 C water per day per person. In discussions with the owner it was estimated that occupancy ranged from 100% in summer to 75% in winter. This high of occupancy will offer shorter payback times through greater use.

HOT WATER USE ESTIMATES

The following table is a guide to determine the hot water demand for commercial or light industrial facilities.

DEVICE	LOCATION	WATER CONSUMED AT 60'C (LITRES)
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Shower	Aged Homes	18 - per person
	Domestic Dwellings	15 - per person
	Caravan Parks	18 - per person
	Hotels/Motels	18 - per person
Baths	Domestic & Hotels	60 - per person per day
Wash Sink	Domestic Dwellings	2 - per person per day
	Offices	1 - per person per day
Kitchen Sink	Domestic Dwellings	7 - per sink full
	Hotel/Motel	10 - per sink full
Dish Washers	Domestic Dwellings	10 - per meal
	Hotel/Motel	90 - per hour
	One Meal Sitting	2 'hour' Operation
	Two Meal Sitting	4 'hour' Operation
Glass Washers	Hotel Bars	
	Weekdays 3 hours use/day	55 - per hour per unit
	Weekends 5-6 hours use/day	
Restaurants		6 - 10 per hot meal
Full Laundry		27 - per person per day

Dish Washers And Glass Washers

As some dishwashers have their own water heating system, not all dishwashers will require inclusion with the hot water demand calculations. The types installed should be checked prior to calculating the hot water demand.

Using the above estimates for hot water use and occupancy we can expect to see an average motel room use of between 20 to 30 liters per person day. Motel totals will depend on winter or summer occupancy levels but since summer is the only period when solar is available we can concentrate on this time frame. To ensure accuracy it would be necessary to monitor all motel water use for a period of three months prior to sizing a solar system. Such monitoring should occur after installation of any water conservation measures.

Meals per day data were not available at the time of my site observation and this will greatly affect restaurant hot water use. Averaging 8 liters per hot meal can be used as a conservative estimate. Estimates of the average number of summer meals prepared however is difficult to come by and without monitoring the water flow, any estimate would be a guess.

In regards to the above considerations and estimates with summer occupancy at or near 100% and assuming each person eats one and a half hot meals per day, we could have as much as 1400 to 1800 liters per day of demand. Given the high percentage of clear days in Beaver Creek and using rudimentary calculations the use of solar preheating appears to give a favorable payback for an appropriately sized system. If the decision is made to construct a mechanical room the area could be easily designed to accommodate the additional plumbing needed to install and integrate domestic water heating with a solar preheater.

I would defer my actual recommendation for such a system to be installed to others that are more familiar with the solar potential derived from various panel manufacturers.

REFRIGERATION

Currently, each motel room contains a small kitchenette and refrigerator. In terms of usefulness, these are greatly underutilized by a majority of occupants. The units are mostly old, inefficient, and always on whether the room is occupied or not. Removing the units from a majority of rooms would result in significant savings without burdening the occupants. Leaving a few rooms with refrigerators designated for longer-term occupancy would make sense and buying newer units, which are much more efficient, would also be an alternative.

APPENDIX A

1202 MOTOR INN - EXTERIOR PHOTOS:

LODGE and COMPLEX

BUILDING A

BUILDING B

BUILDING C

BUILDING D

1202 Motor Inn

Lodge

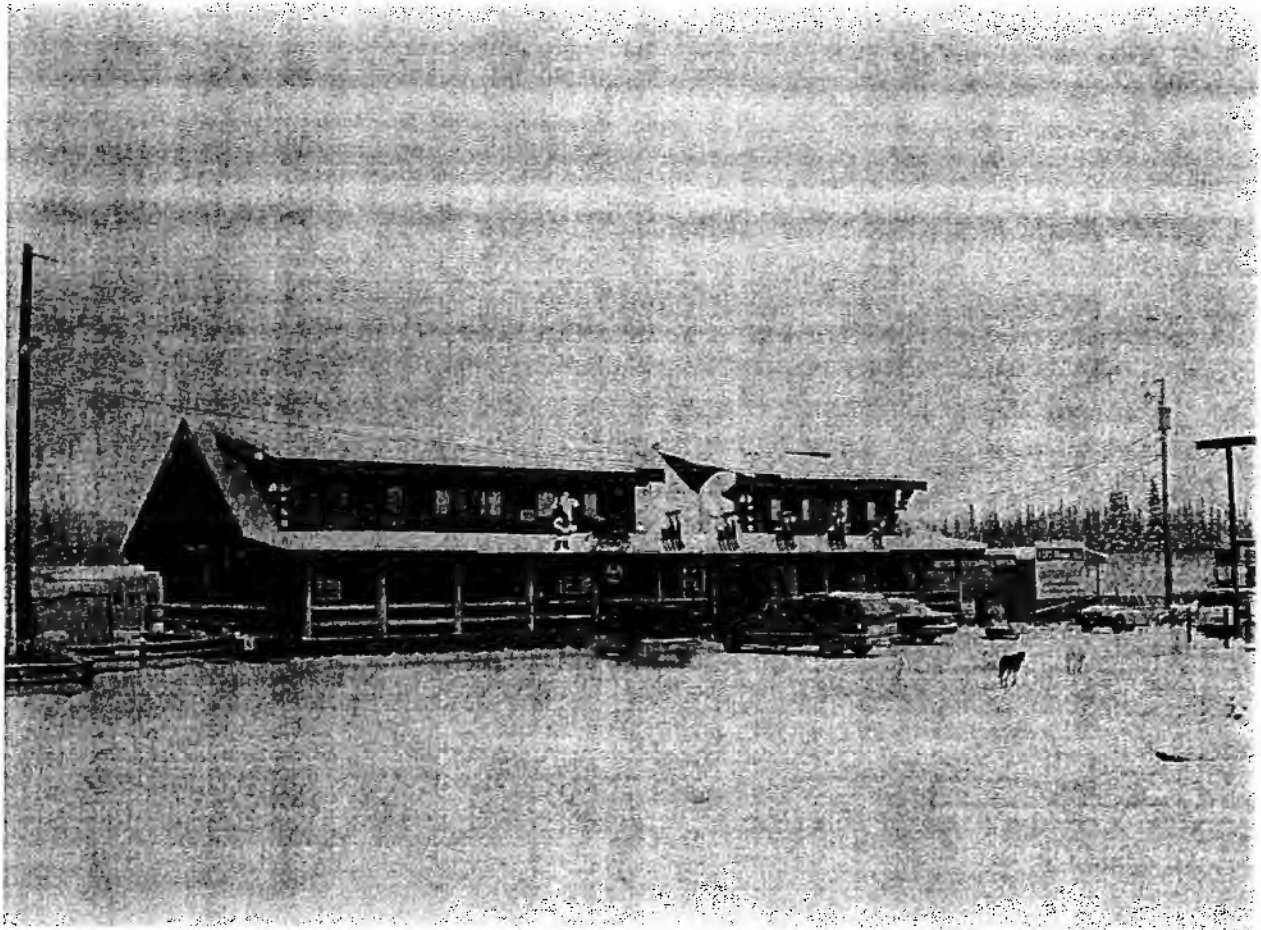
View from Alcan Highway, looking Northwest



1202 Motor Inn

Lodge

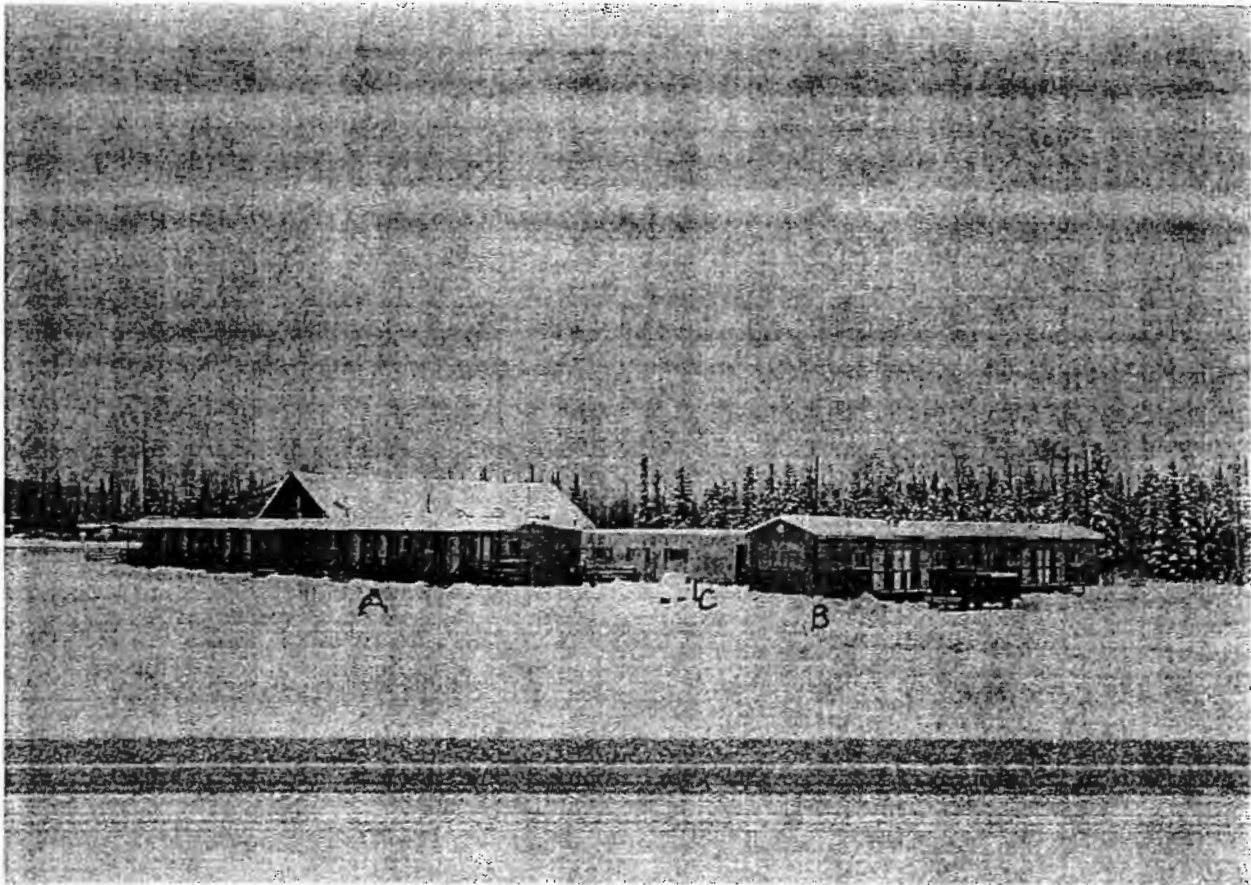
View from Alcan Highway, looking Northeast



1202 Motor Inn Complex

Looking Northwest

(Bldg. A is on left, Bldg. C in middle and Bldg. B on right)



1202 Motor Inn Complex

Looking Southwest

(Bldg. B is on left, Bldg. C in middle and Bldg. D on right)

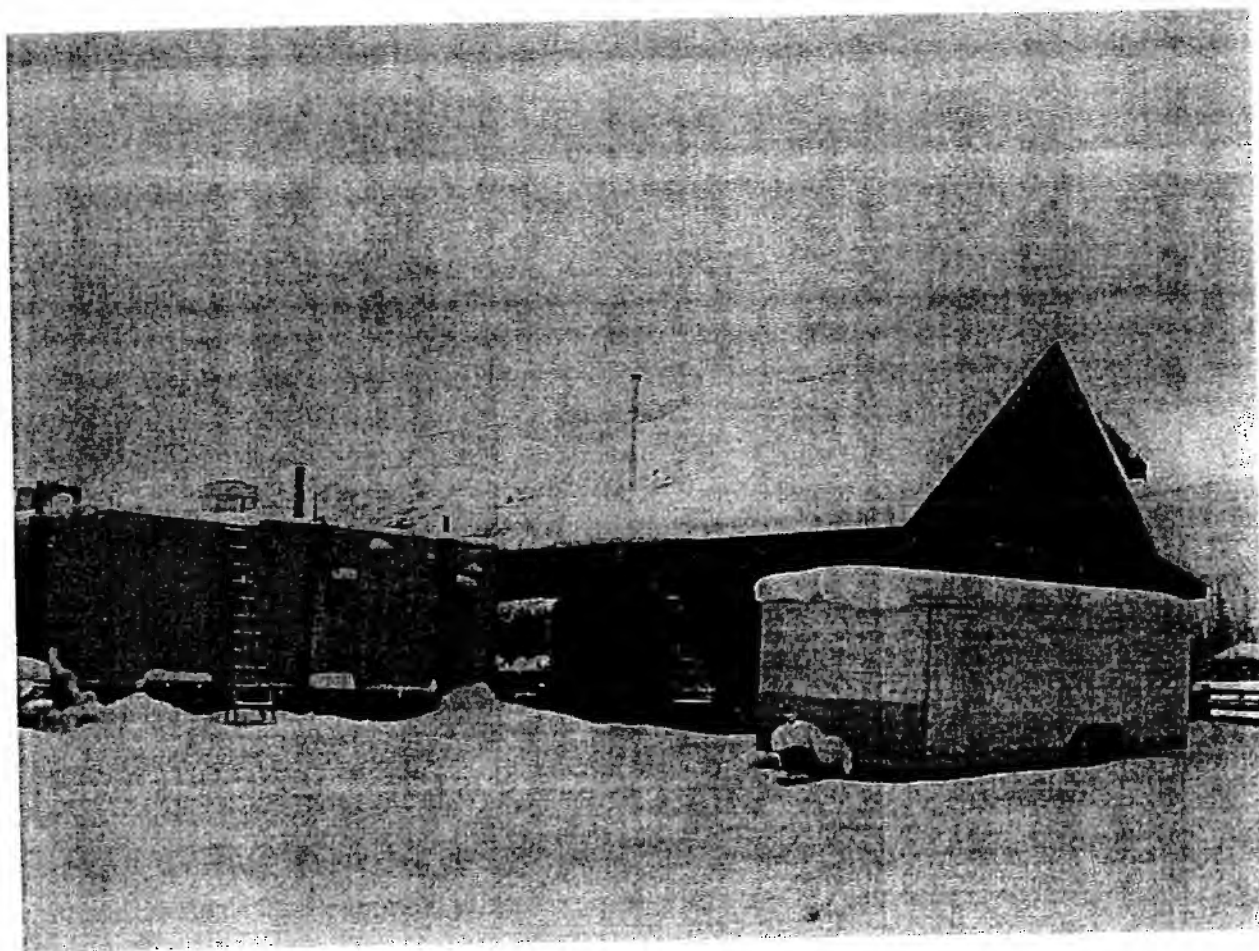


1202 Motor Inn Complex

Kitchen Attachment

Looking Southwest

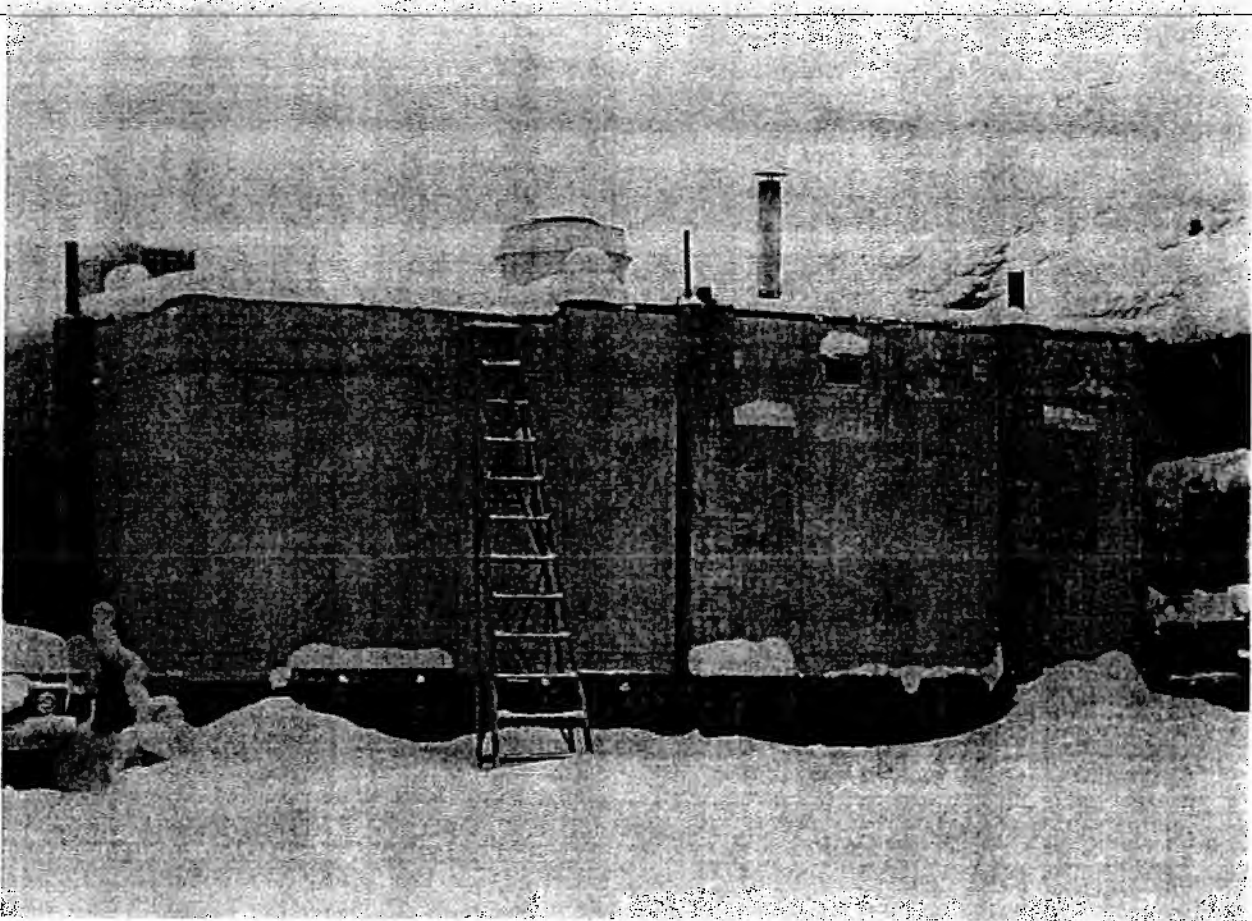
(Kitchen is on left, Lodge on right – note glaciers on lodge roof)



1202 Motor Inn Complex

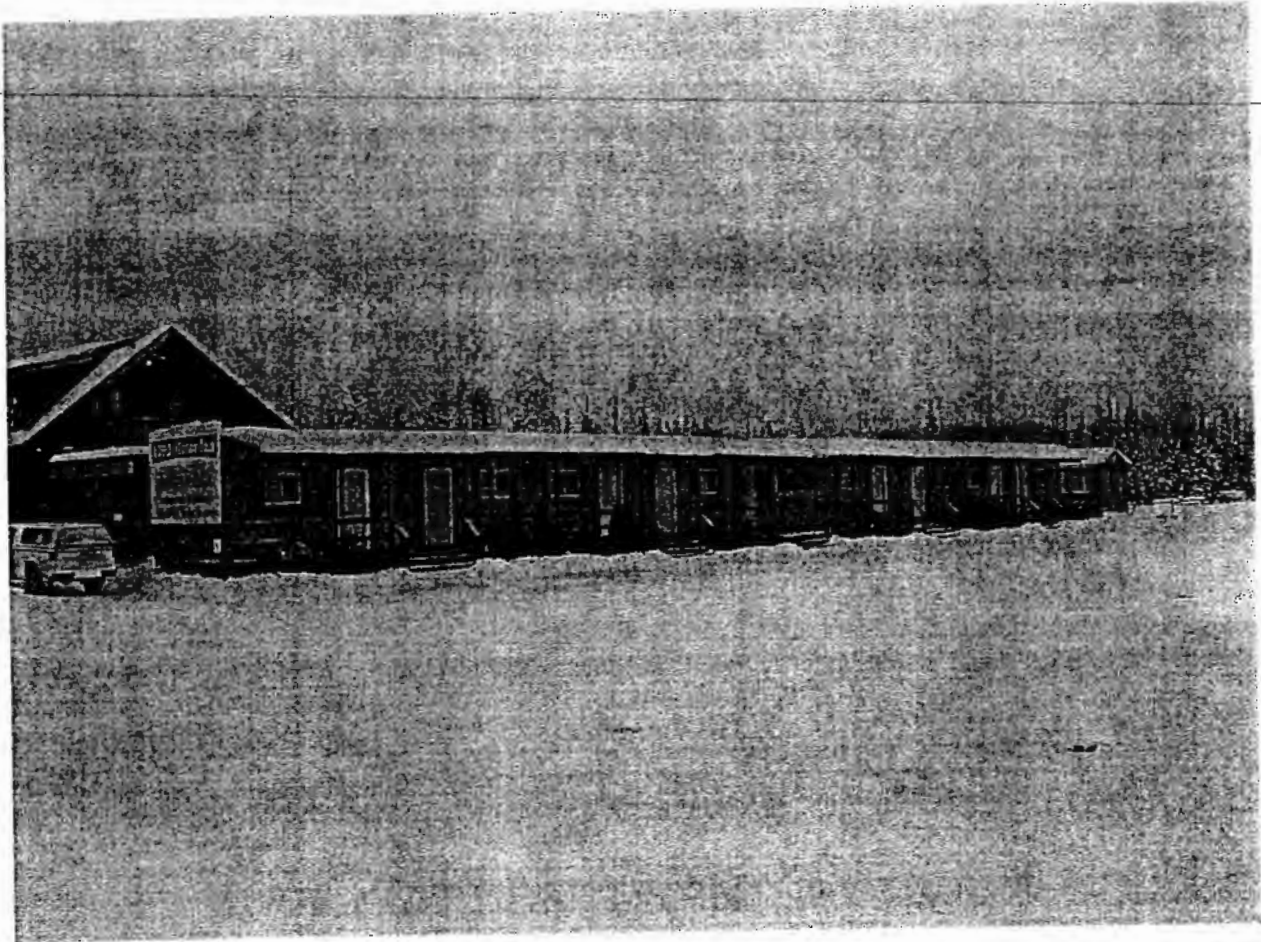
Kitchen Attachment

North wall (note glaciers on lodge roof)



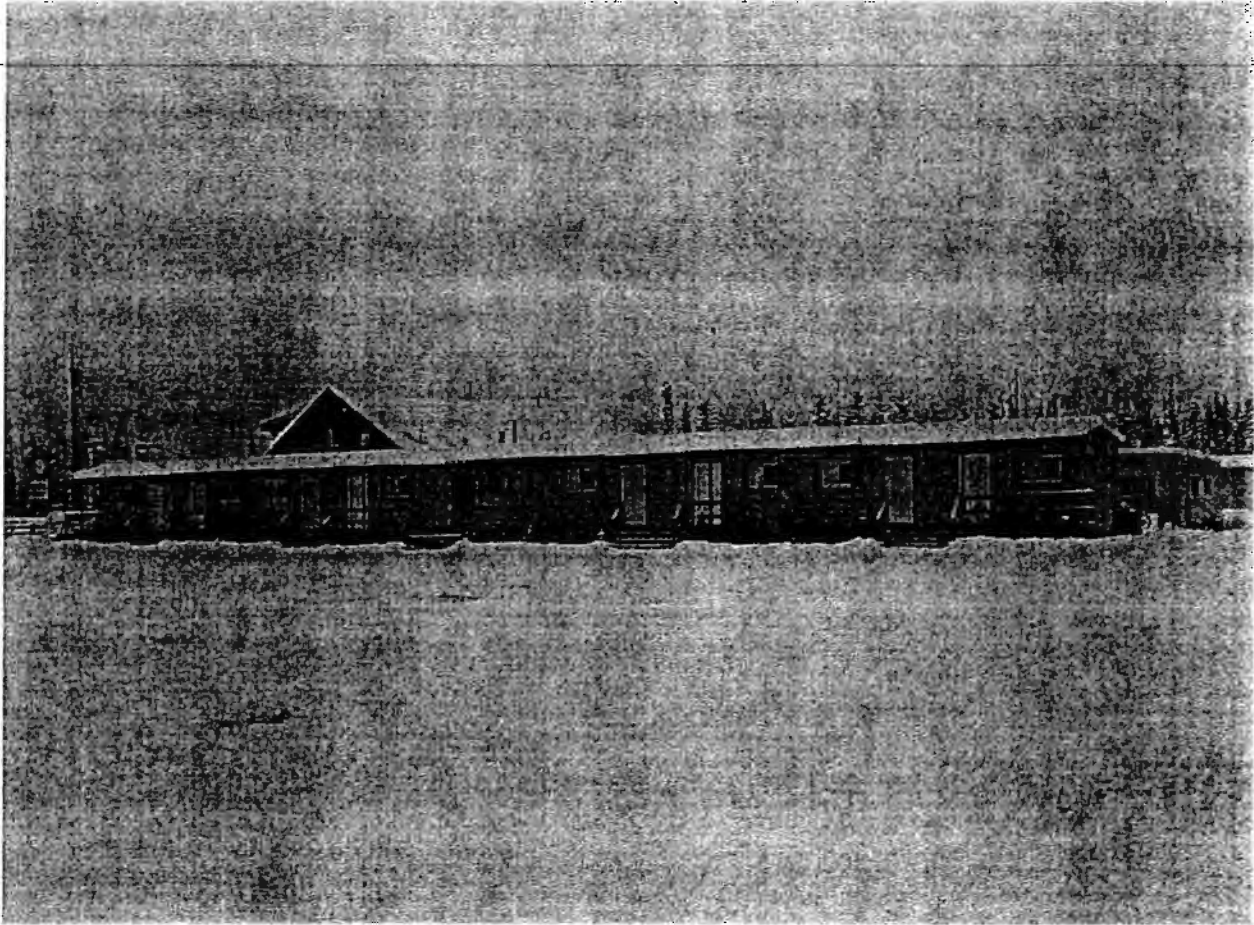
1202 Motor Inn

Building A – Looking Northwest



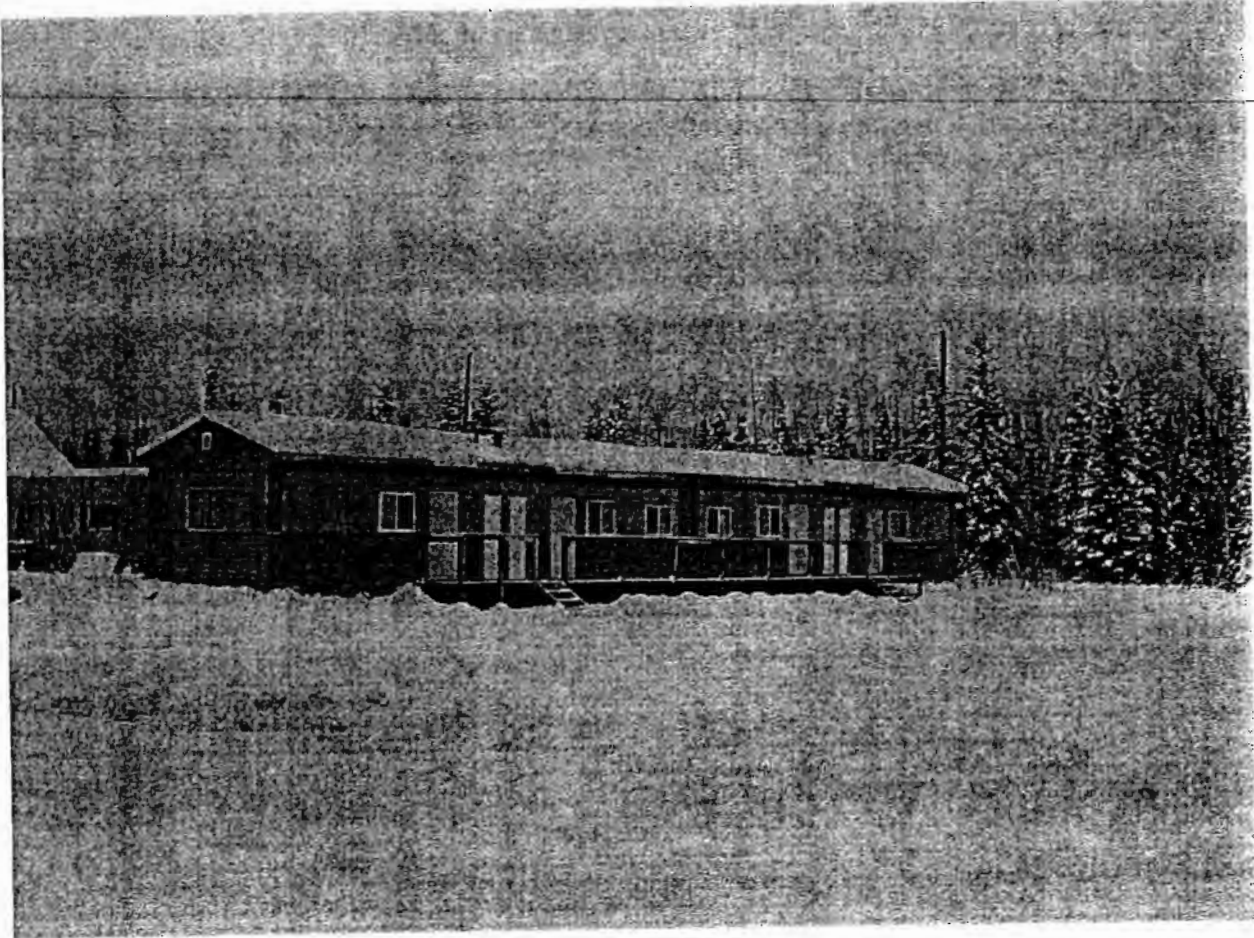
1202 Motor Inn

Building A – Looking Southwest



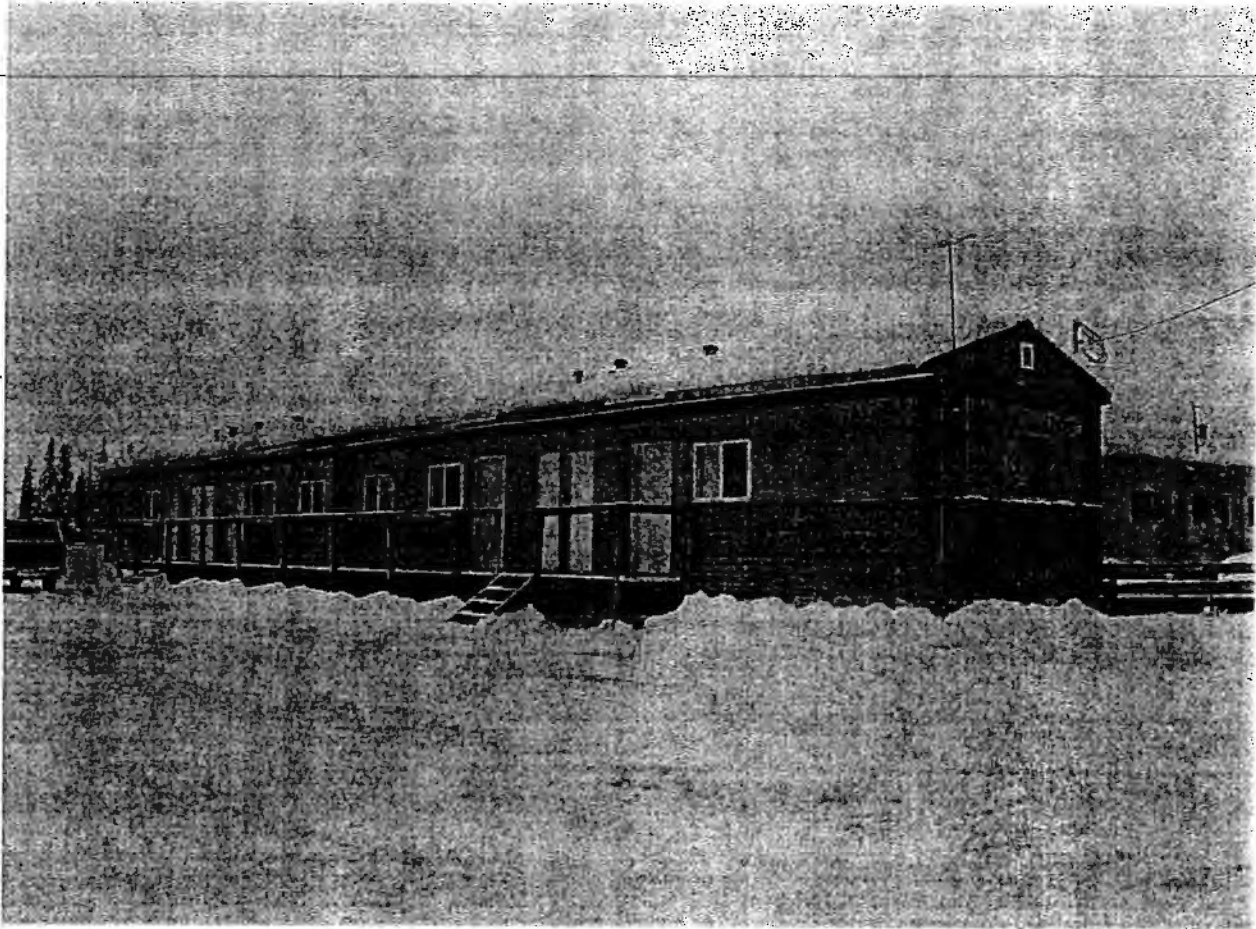
1202 Motor Inn – Complex

Building B – Looking Northwest



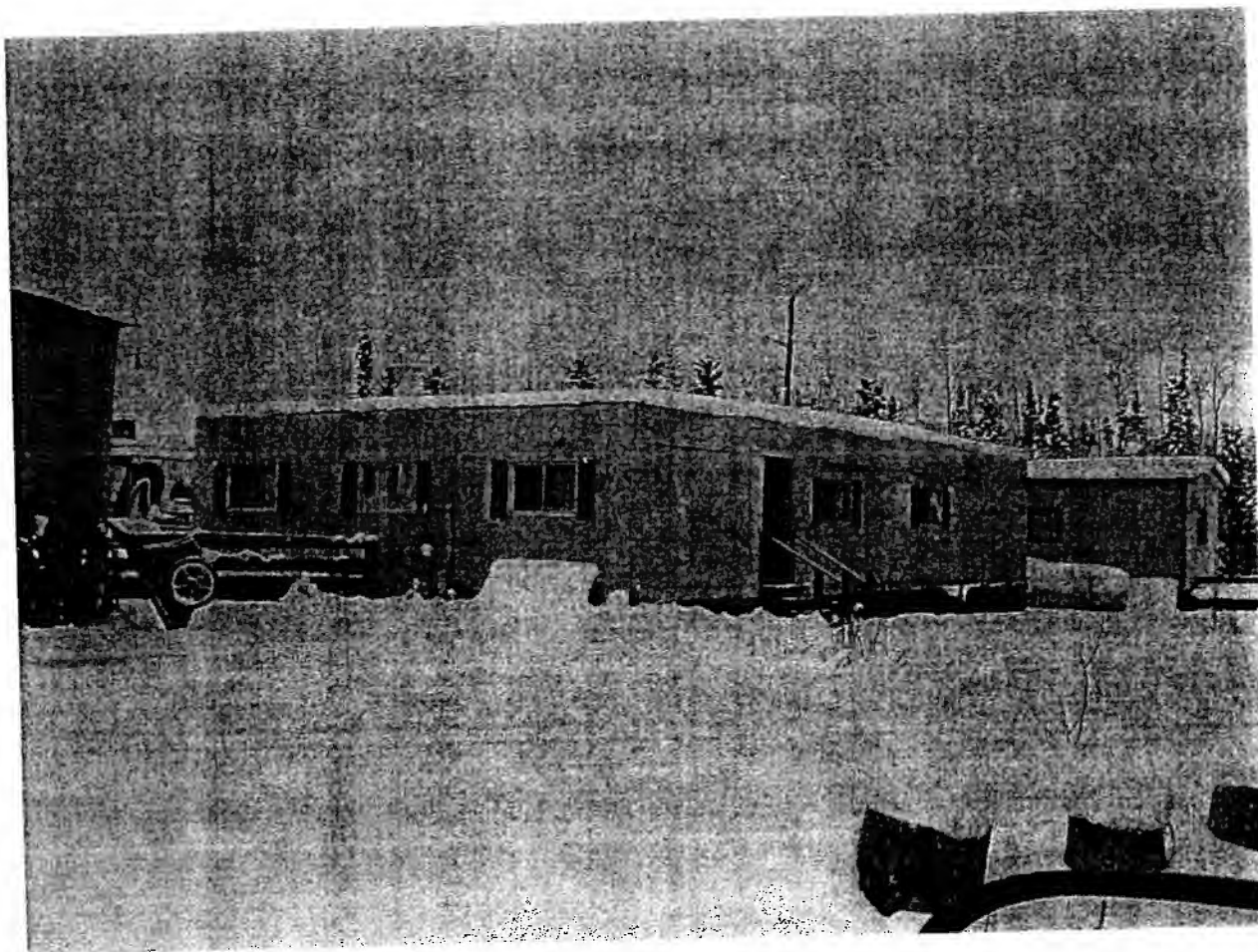
1202 Motor Inn – Complex

Building B – Looking Southwest



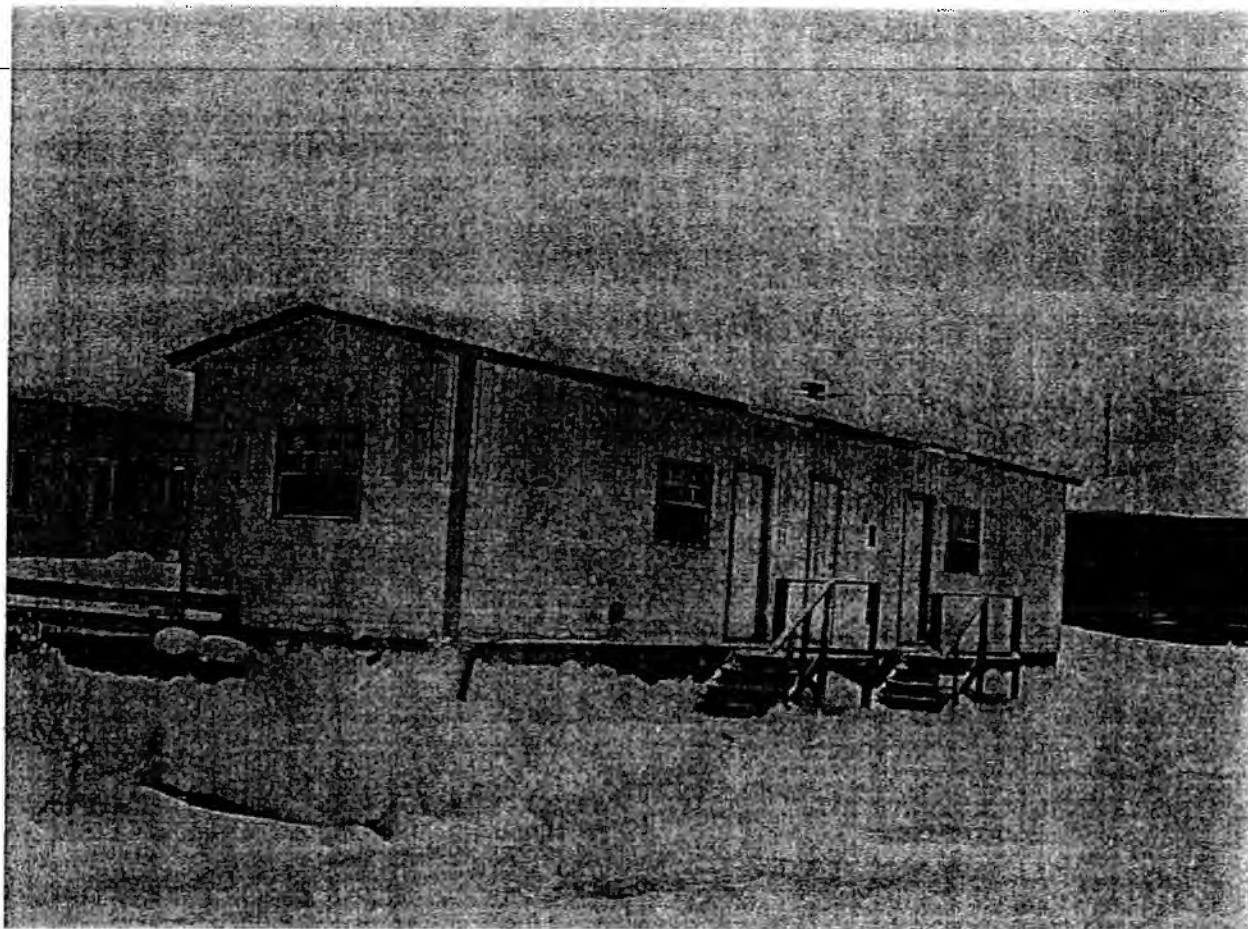
1202 Motor Inn – Complex

Building C – Looking Northwest



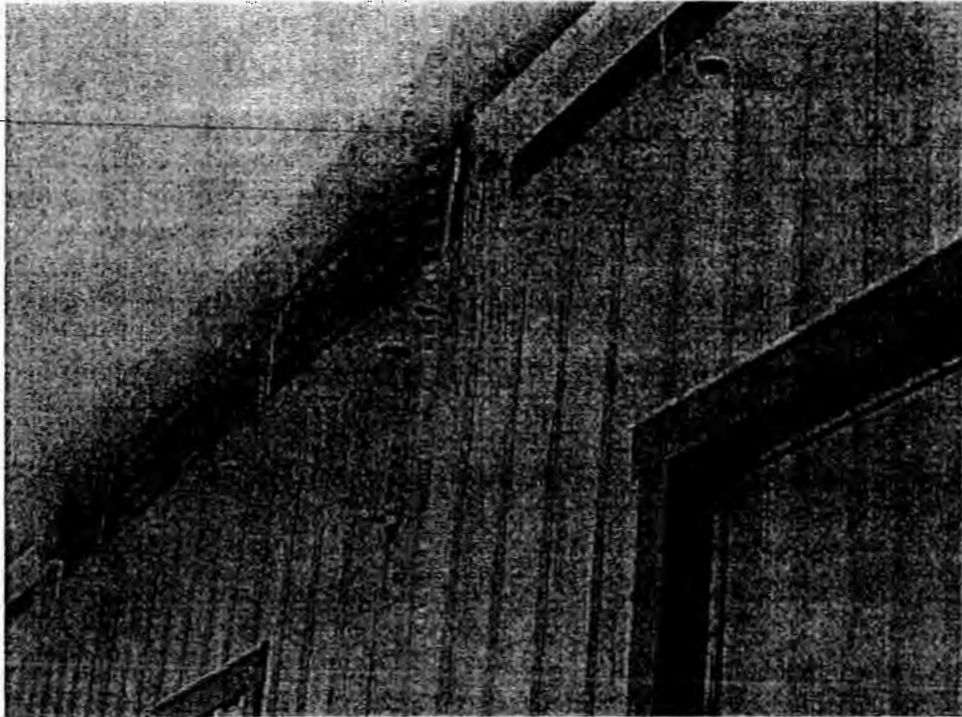
1202 Motor Inn – Complex

Building D – Looking Southeast



1202 Motor Inn – Complex

Building D – North Wall at Eave



Photos show condensation pouring out from the eave vents on building D. This indicates serious air leakage occurring from inside the building leaking into the attic. High air leakage will ultimately destroy the building and possibly cause occupants to become ill from associated mold and mildew.

Below is a close-up of the ice blocked attic vents.



APPENDIX B

1202 MOTOR INN - INTERIOR PHOTOS

LODGE BASEMENT

BUILDING A - MECHANICAL SYSTEMS

BUILDING A - AIR LEAKAGE TESTING

BUILDING B - WATER HEATER AND FURNACE

1202 Motor Inn

Lodge Basement

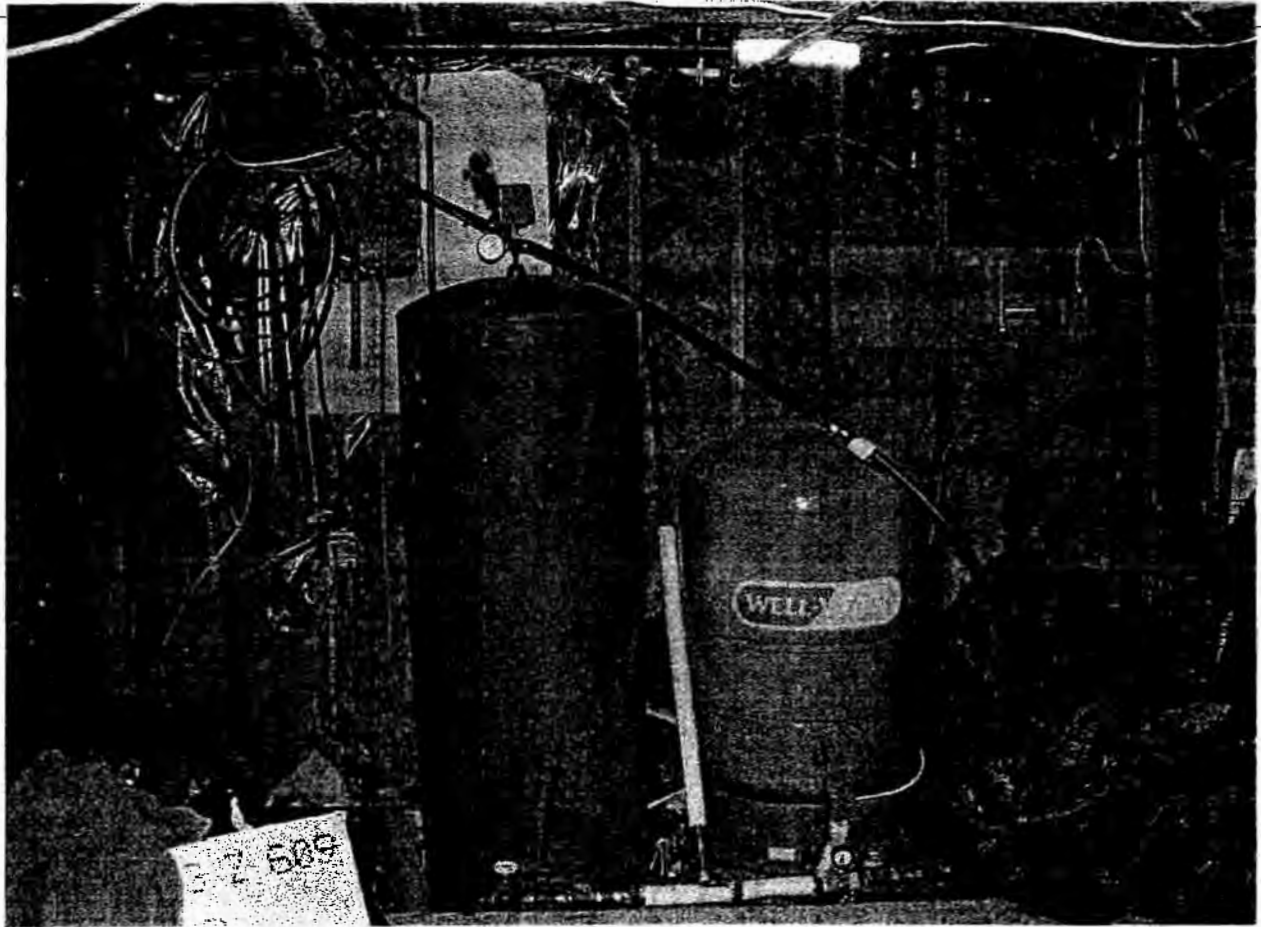
View of basement floor



1202 Motor Inn

Lodge Basement

View of well pressure tank



1202 Motor Inn

Lodge Basement

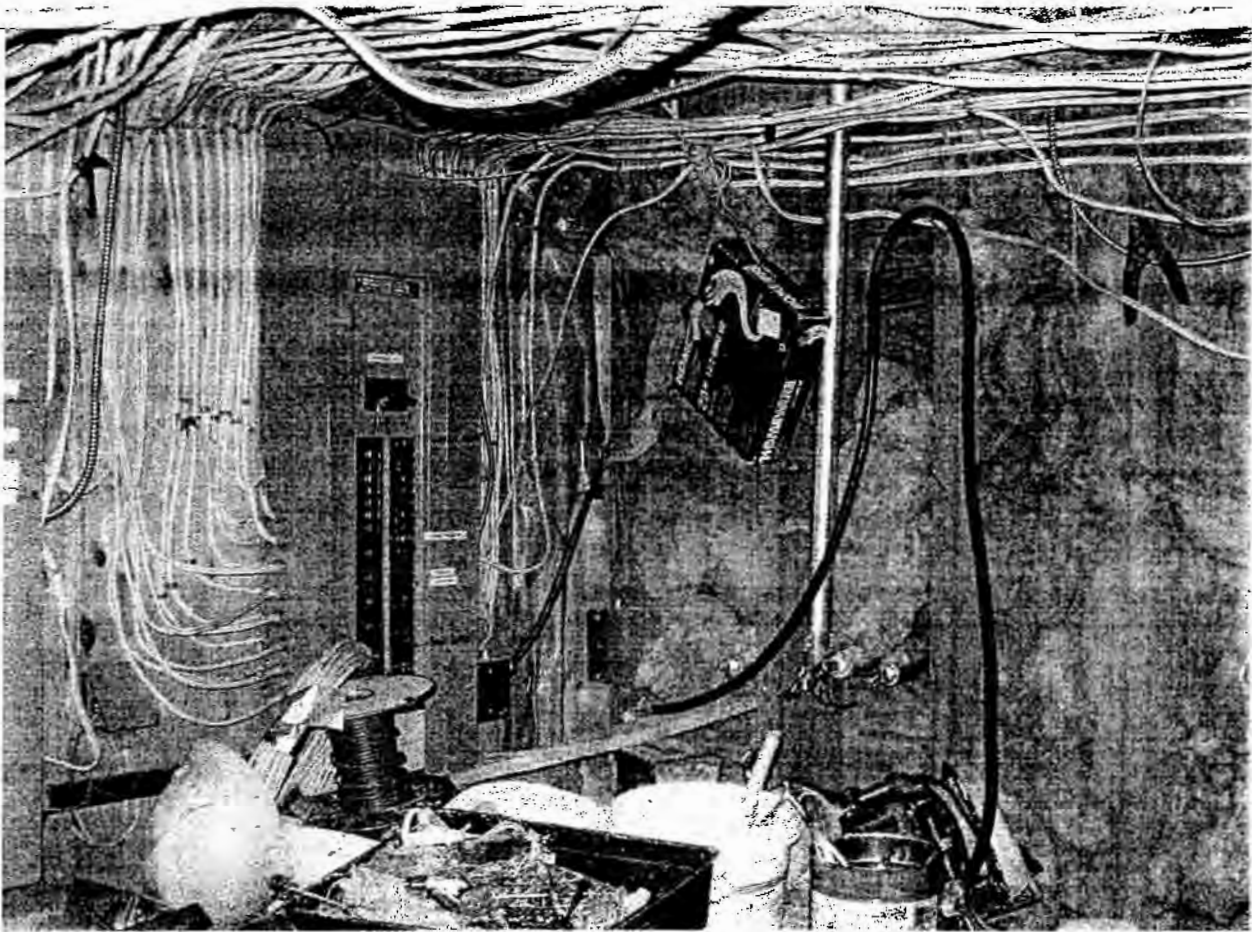
View of basement wall



1202 Motor Inn

Lodge Basement

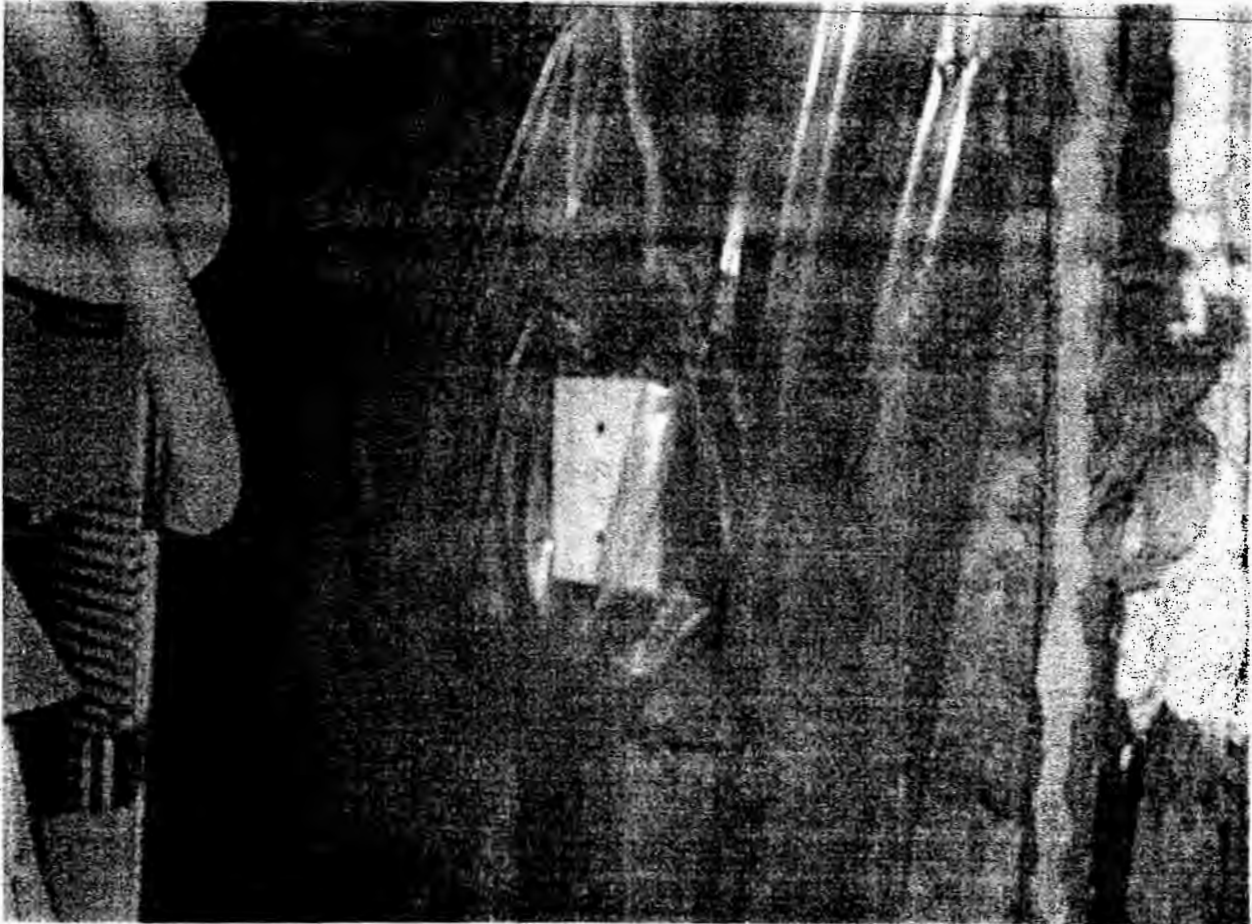
View of basement – electrical panel



1202 Motor Inn

Lodge Basement

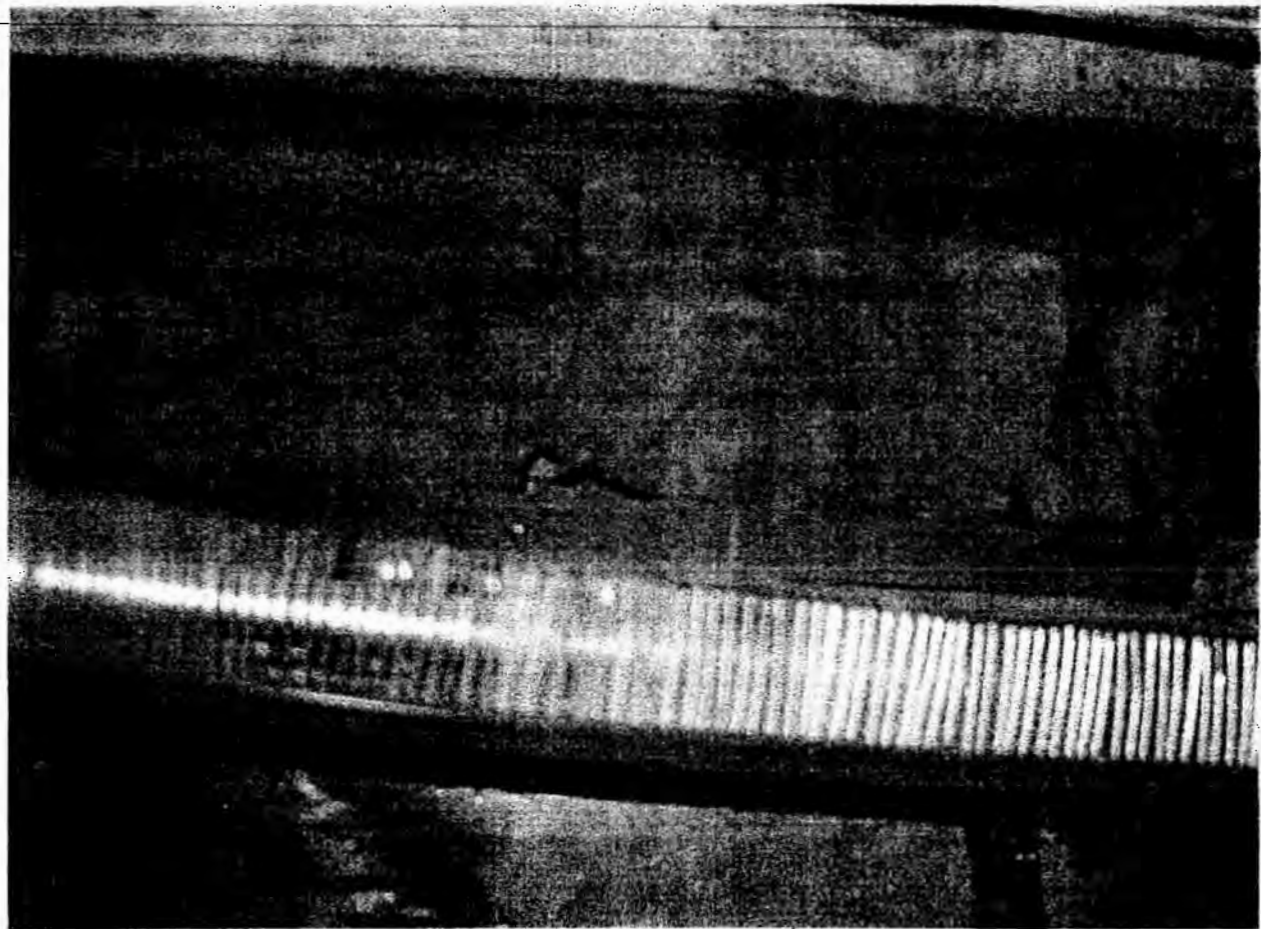
View of basement – air / vapor retarder



1202 Motor Inn

Lodge Basement

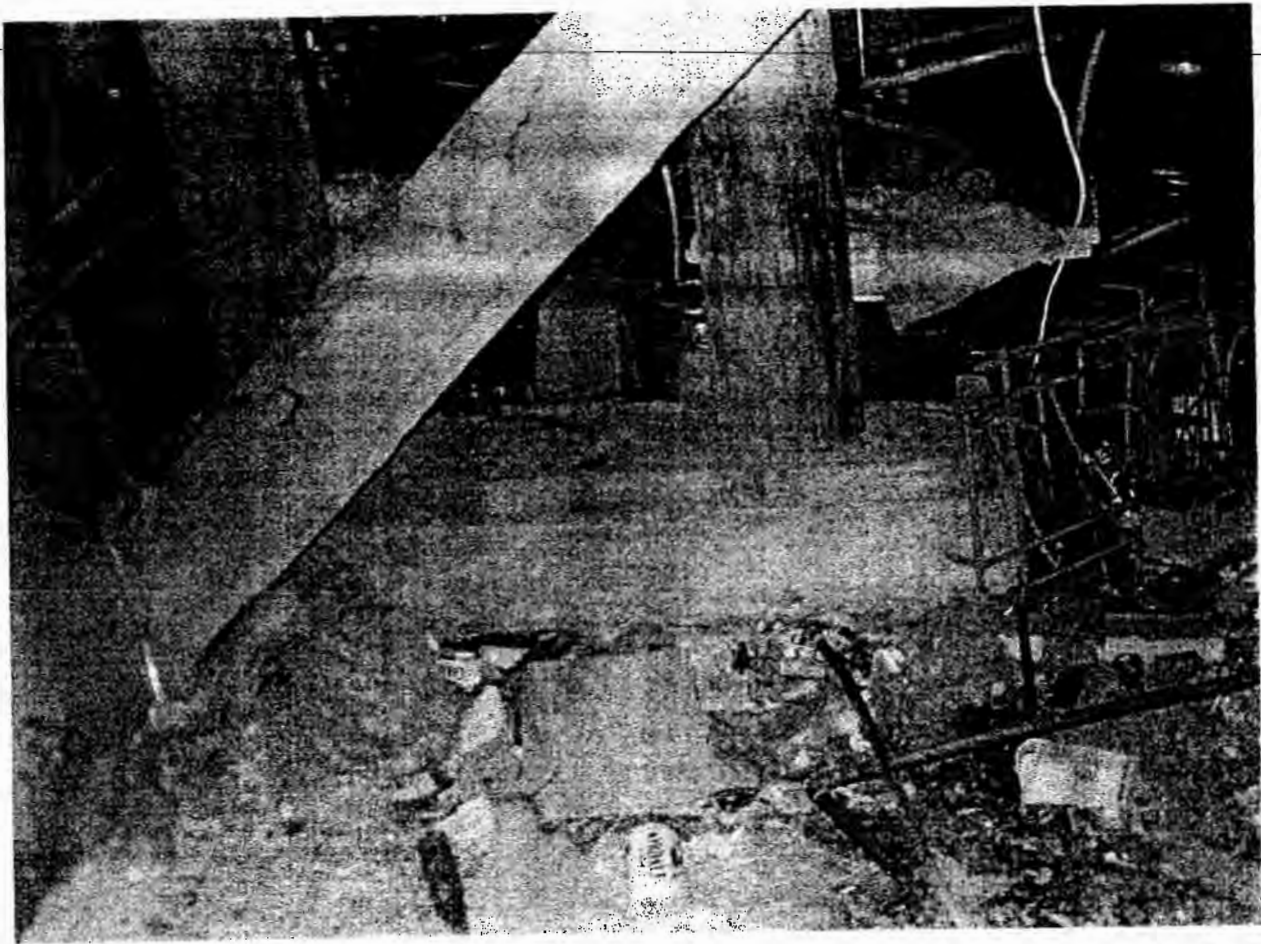
View of basement – rim joist insulation



1202 Motor Inn

Lodge Basement

View of typical foundation pad



1202 Motor Inn

Lodge Basement

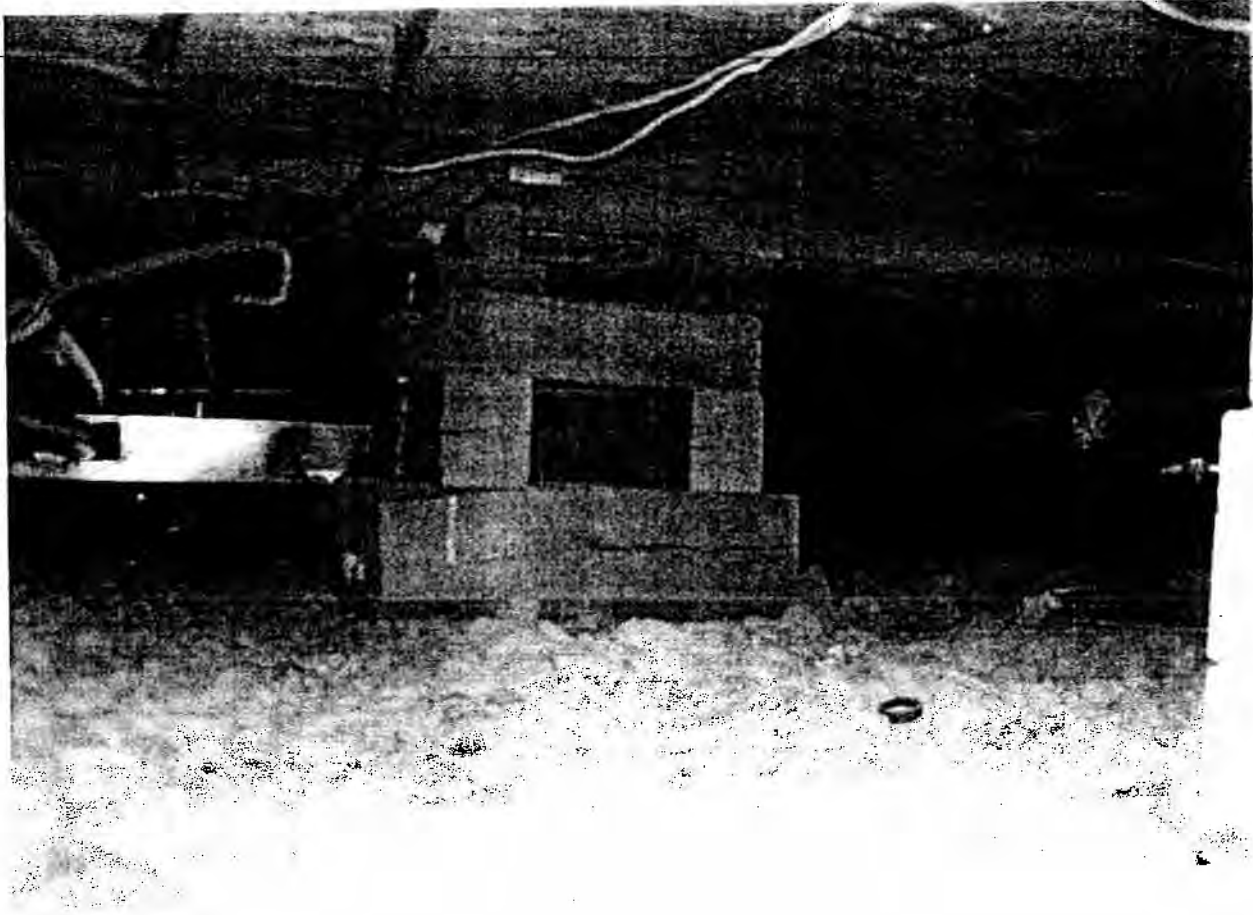
View of Furnace Below Restaurant



1202 Motor Inn

Lodge Basement

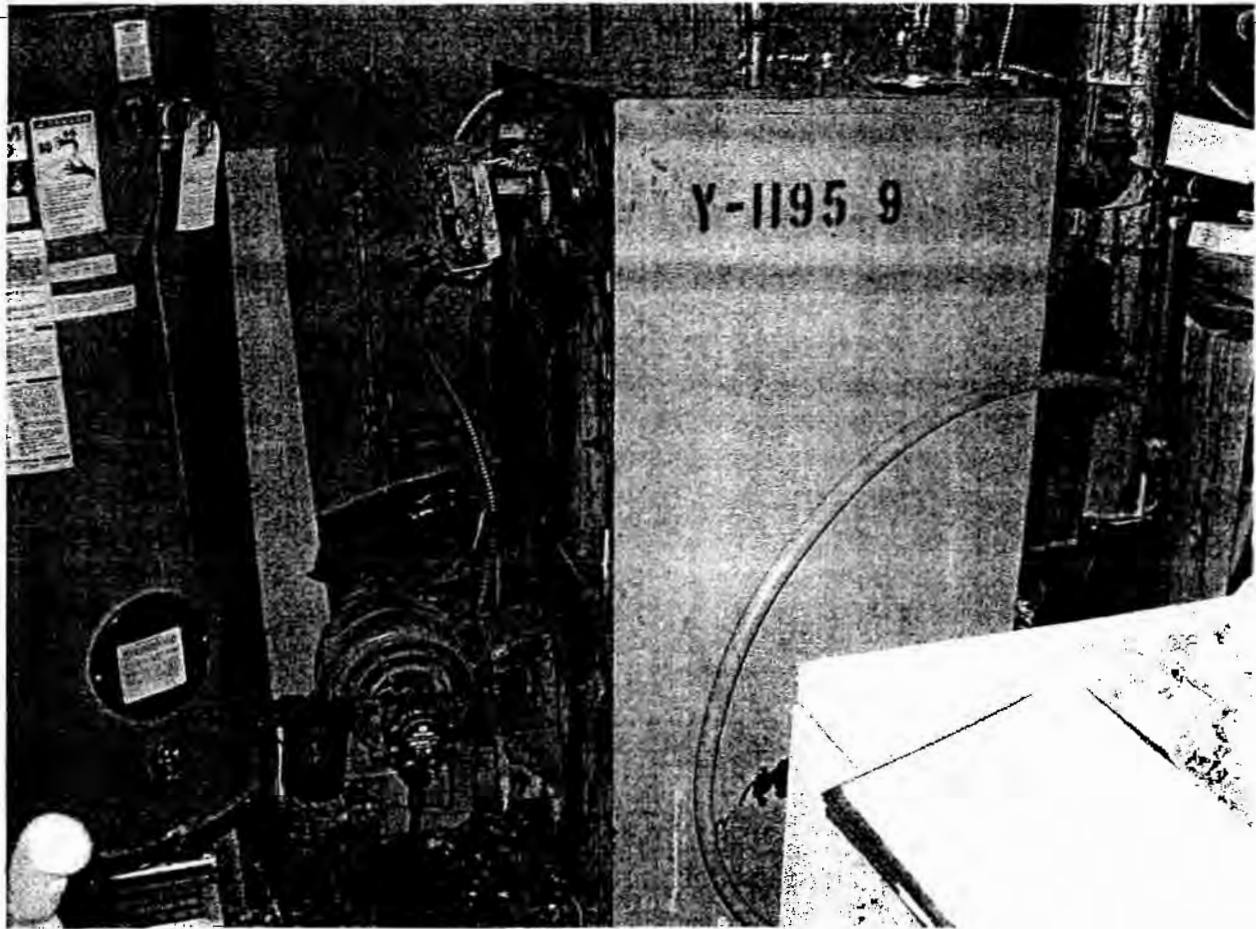
View of Kitchen Foundation



1202 Motor Inn

Building A – Laundry Room

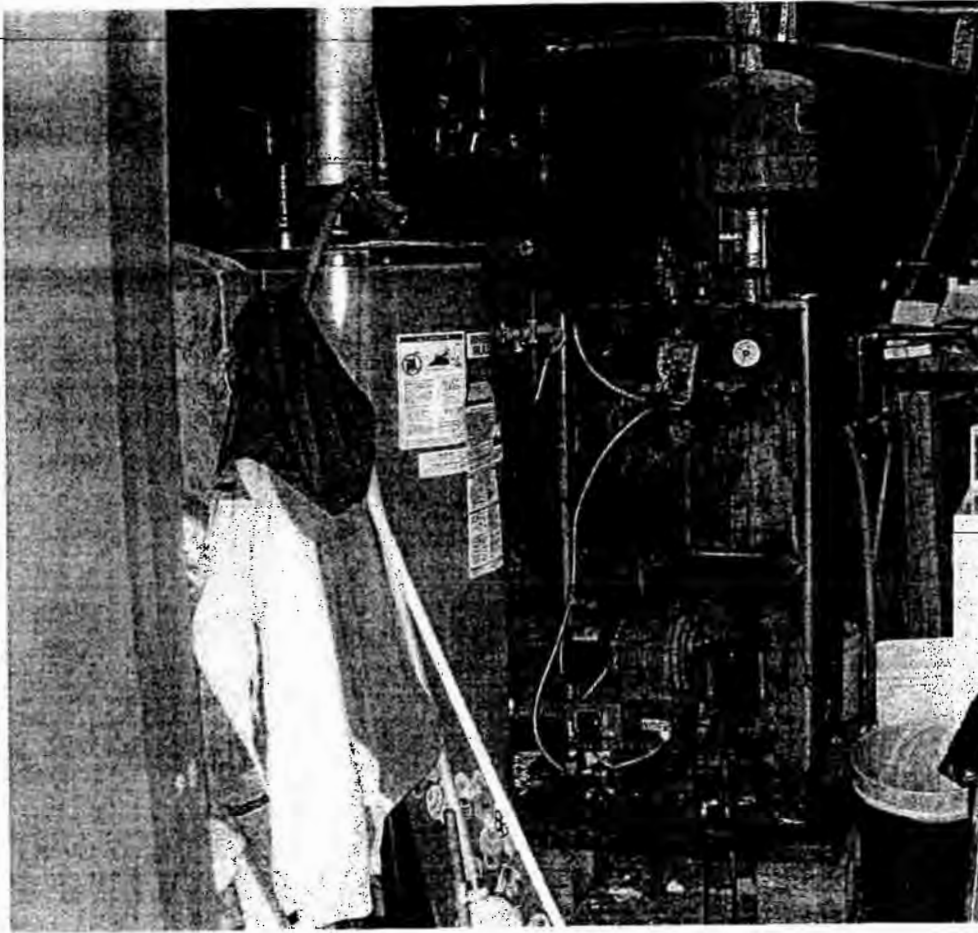
View of Water Heater and Boiler



1202 Motor Inn

Building A – Laundry Room

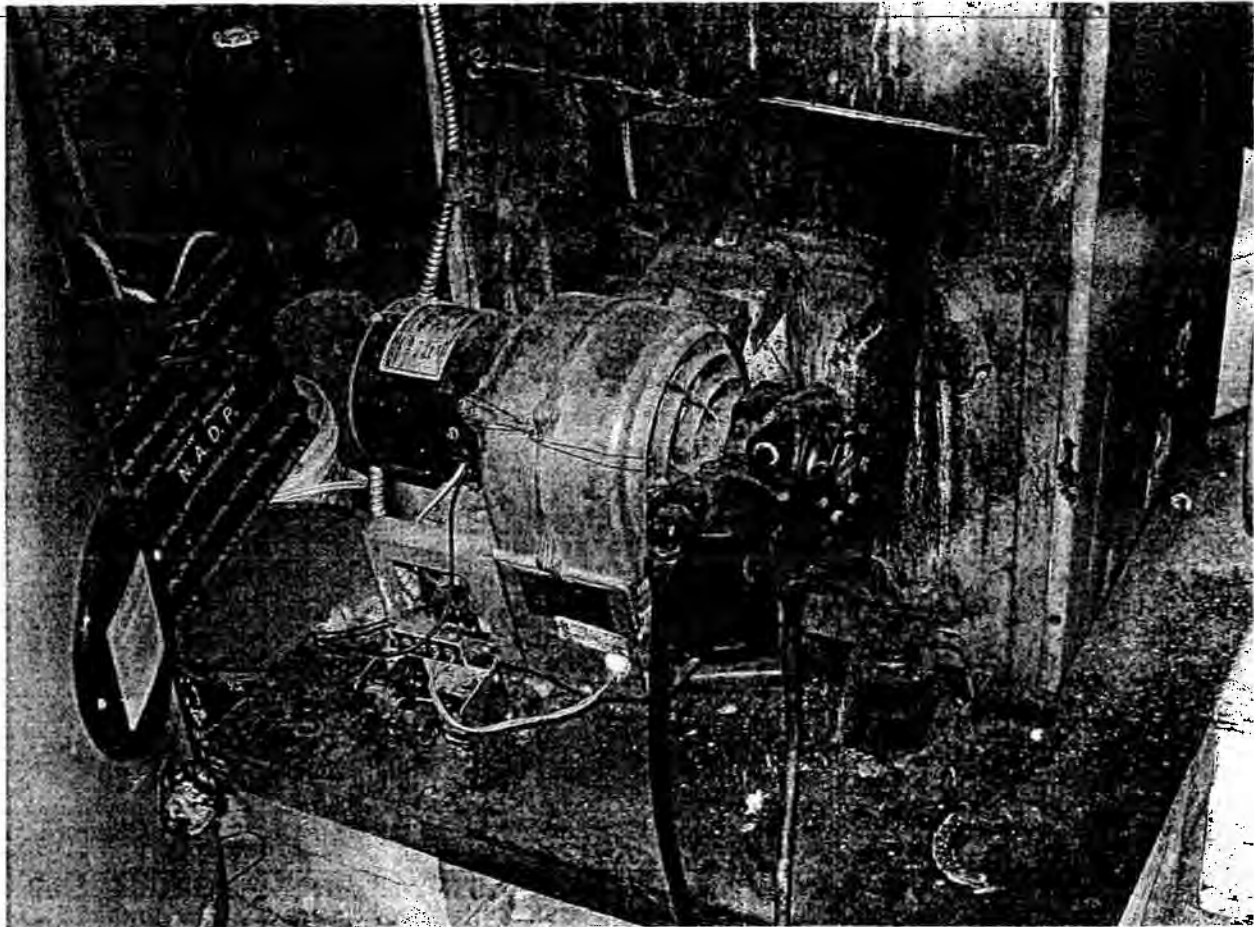
View of Water Heater and Boiler



1202 Motor Inn

Building A – Laundry Room

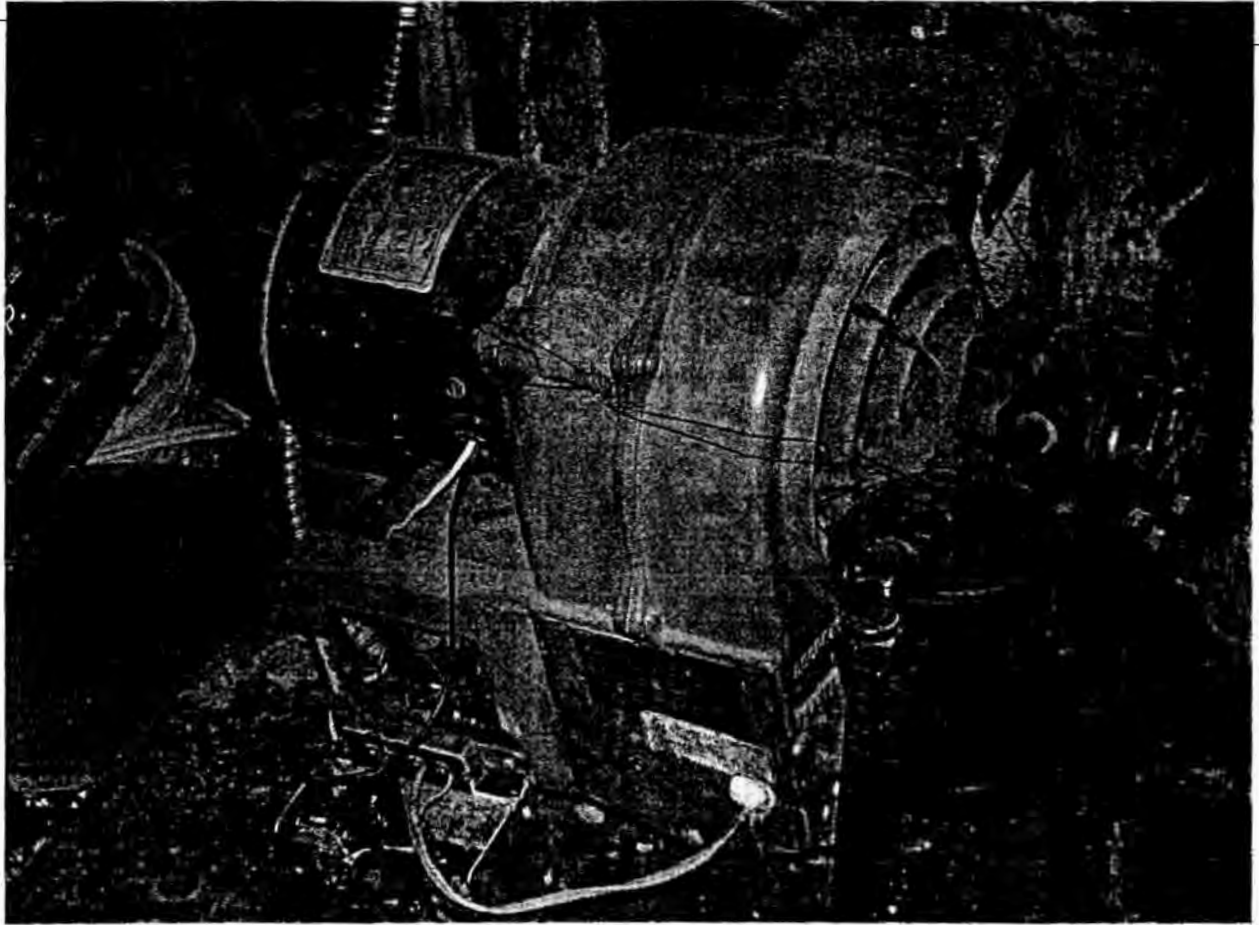
View of Oil Burner on Boiler



1202 Motor Inn

Building A – Laundry Room

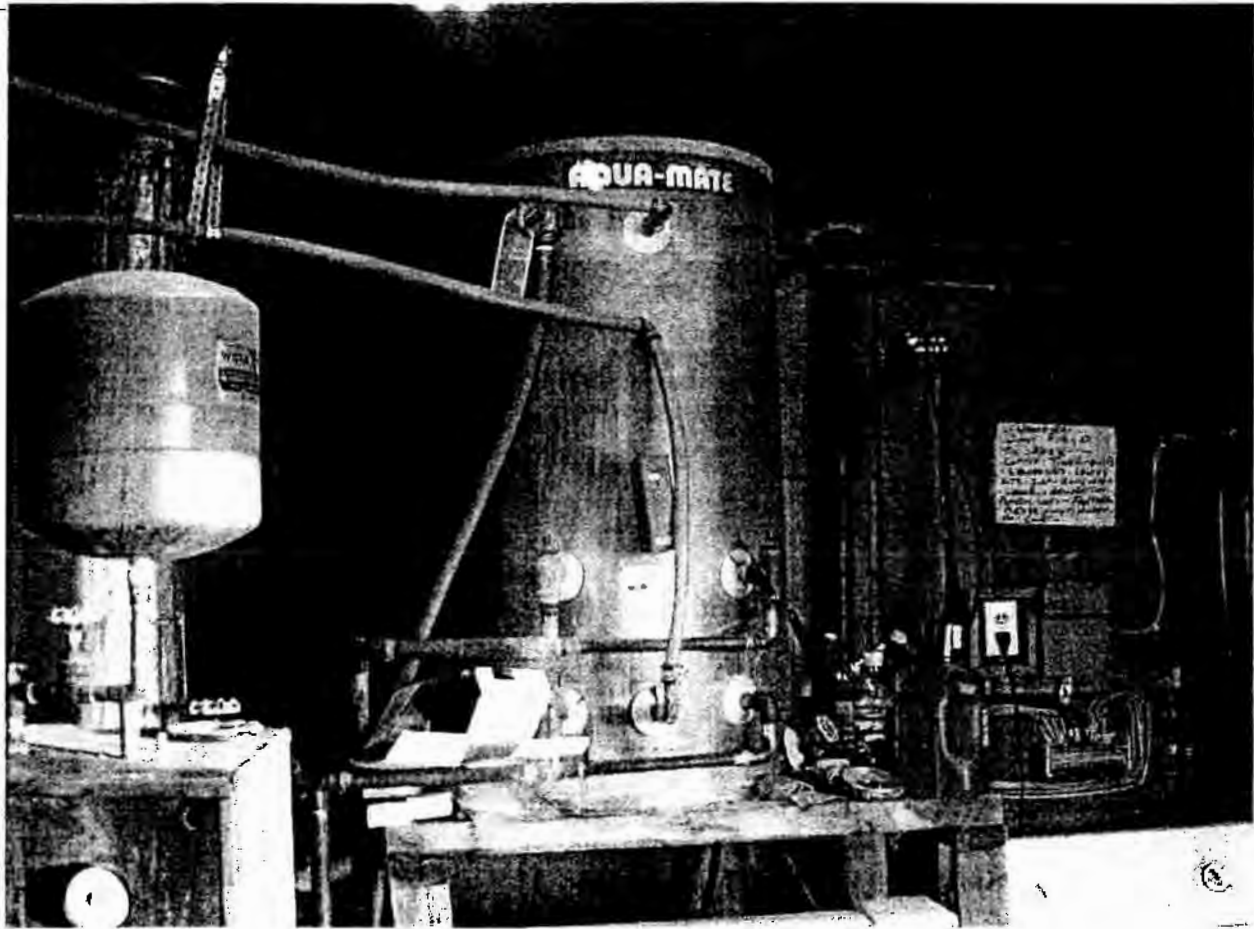
View – Close-up of Boiler Oil Burner



1202 Motor Inn

Building A – Laundry Room

View of Laundry Room – Aqua-Mate



1202 Motor Inn

Building A

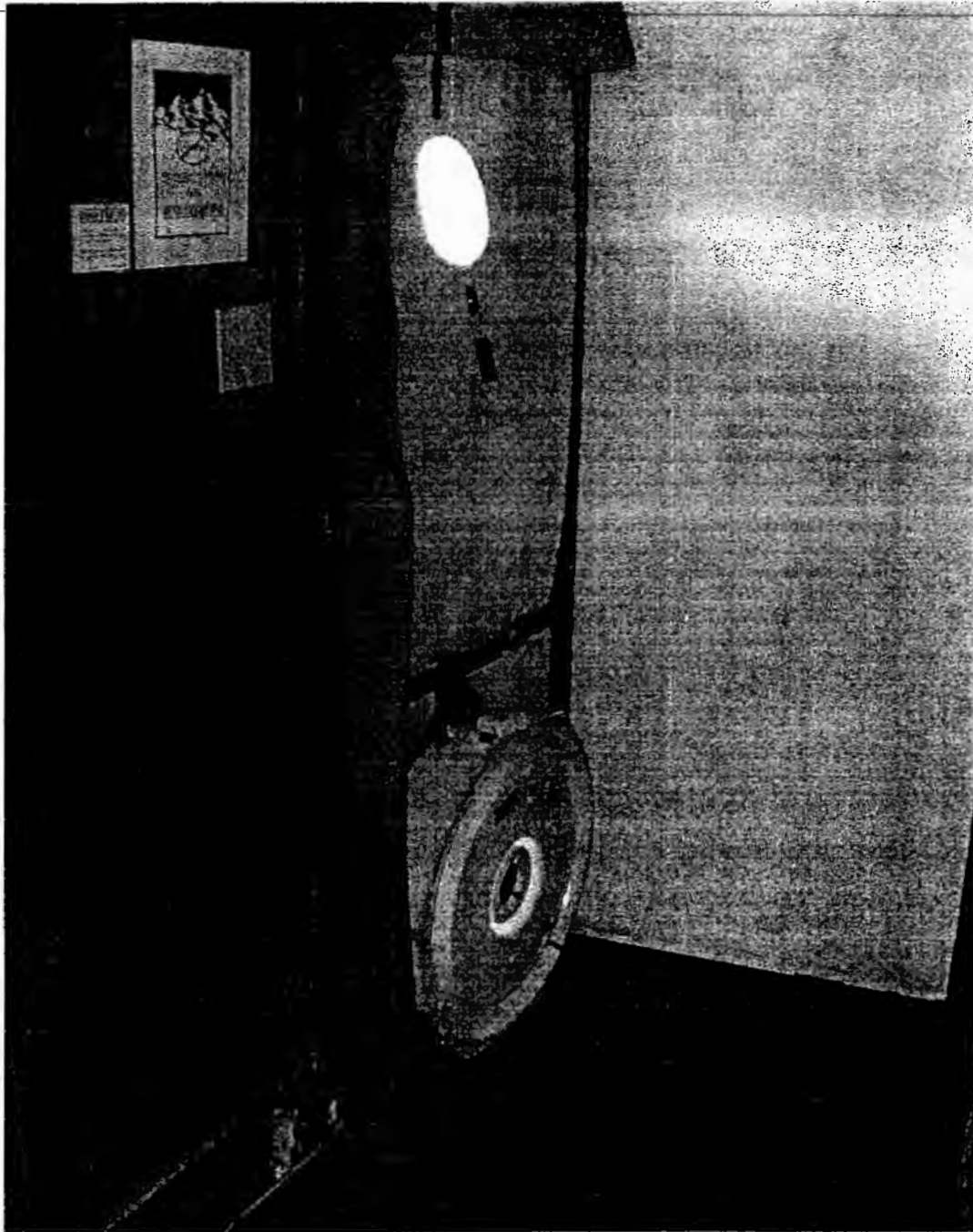
Unit #8



1202 Motor Inn

Building A

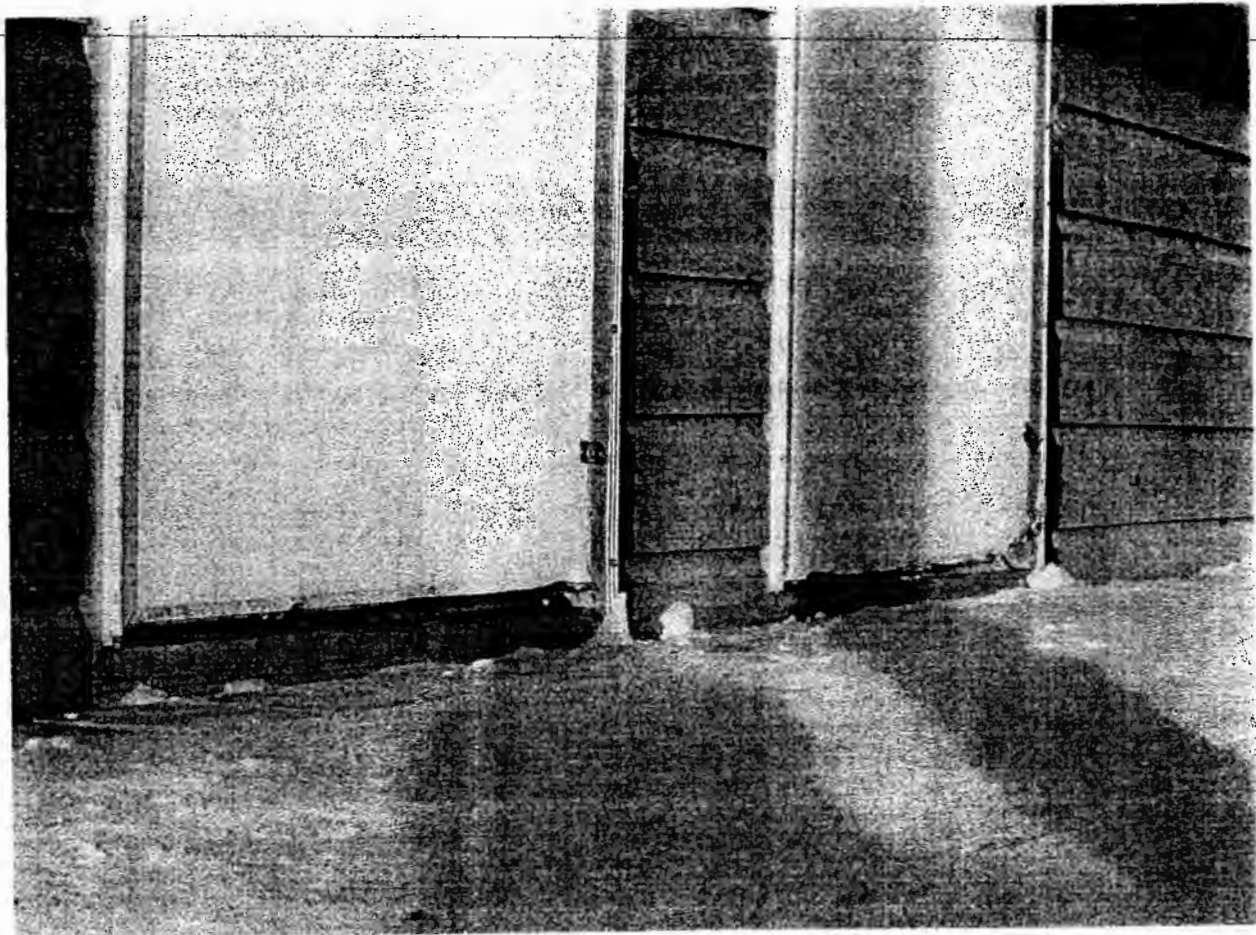
Blower Door Testing Unit #8



1202 Motor Inn

Building B

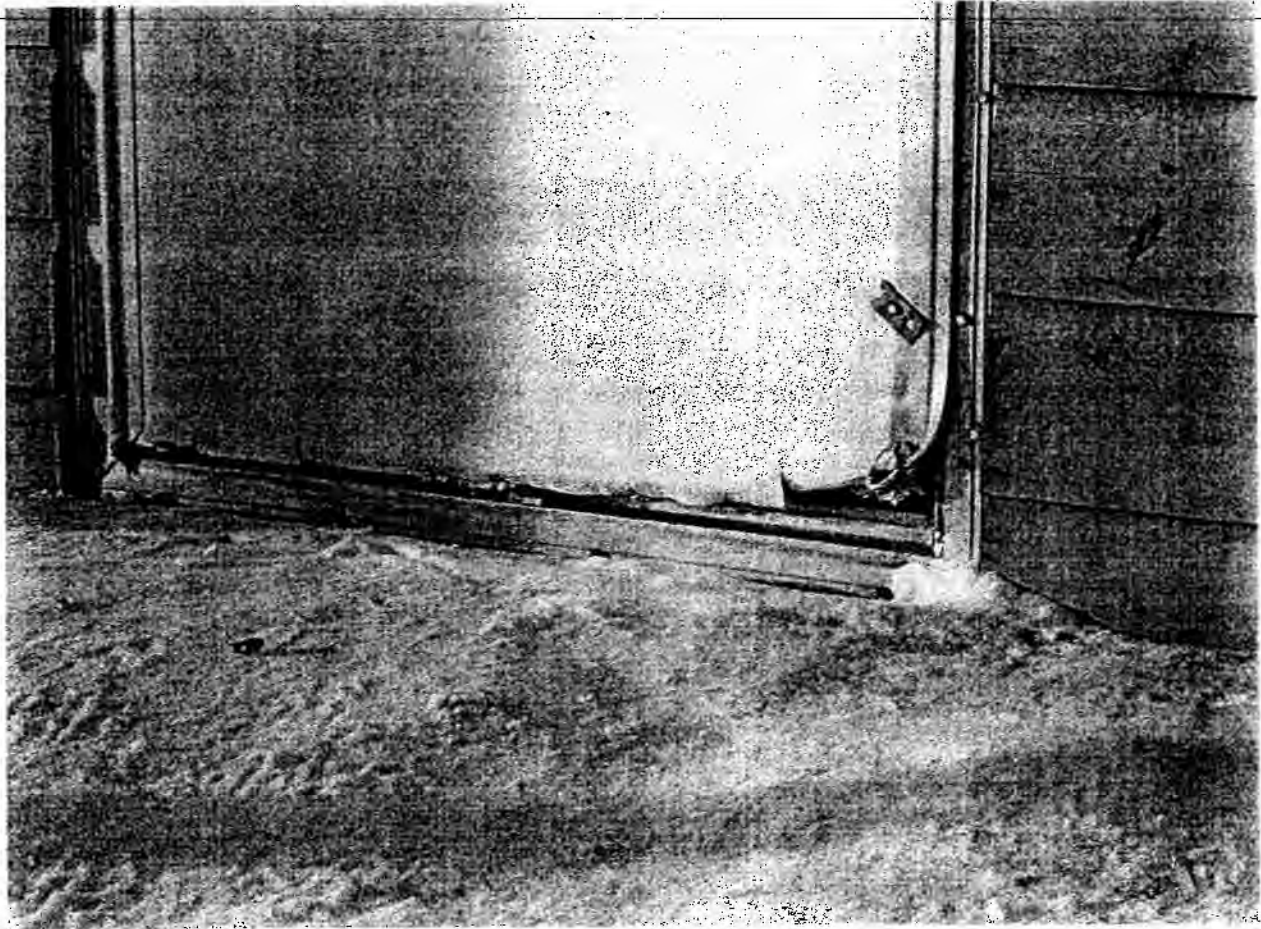
Furnace and Water Heater Room Doors



1202 Motor Inn

Building B

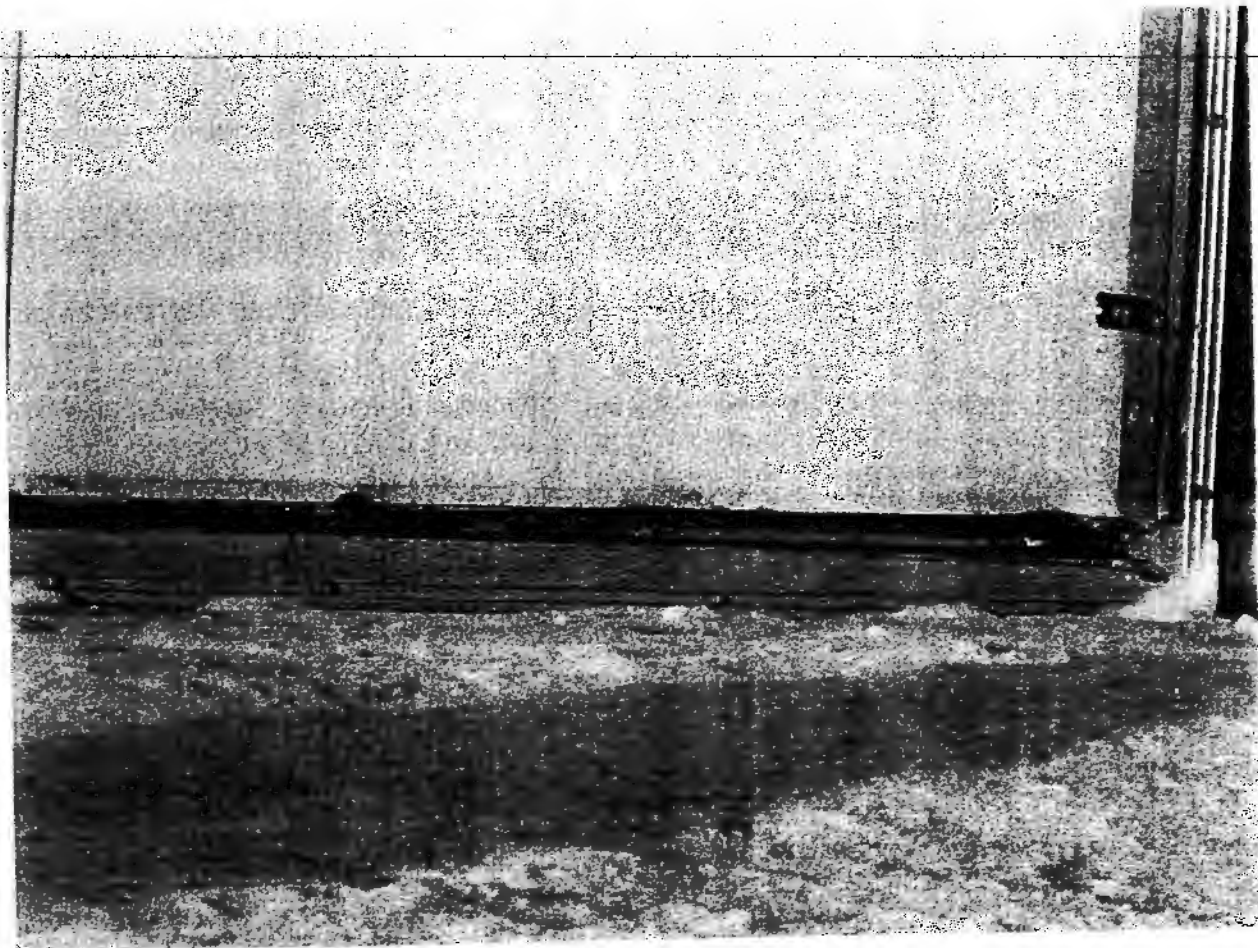
Furnace Room Door – Combustion Air?



1202 Motor Inn

Building B

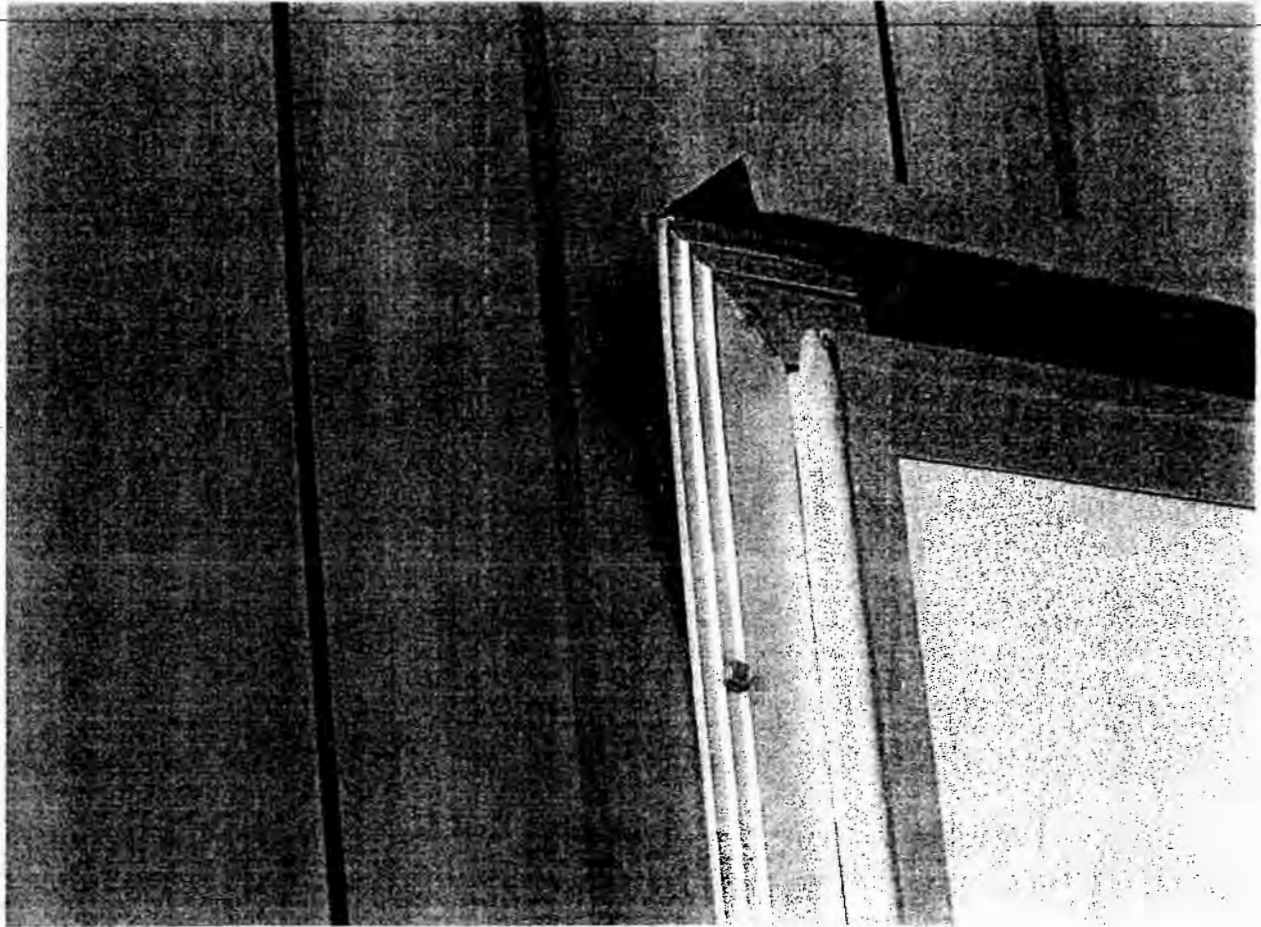
Water Heater Room Door – Combustion Air?



1202 Motor Inn

Building B

Furnace Room Door – Signs of Flue Backdrafting



1202 Motor Inn

Building B

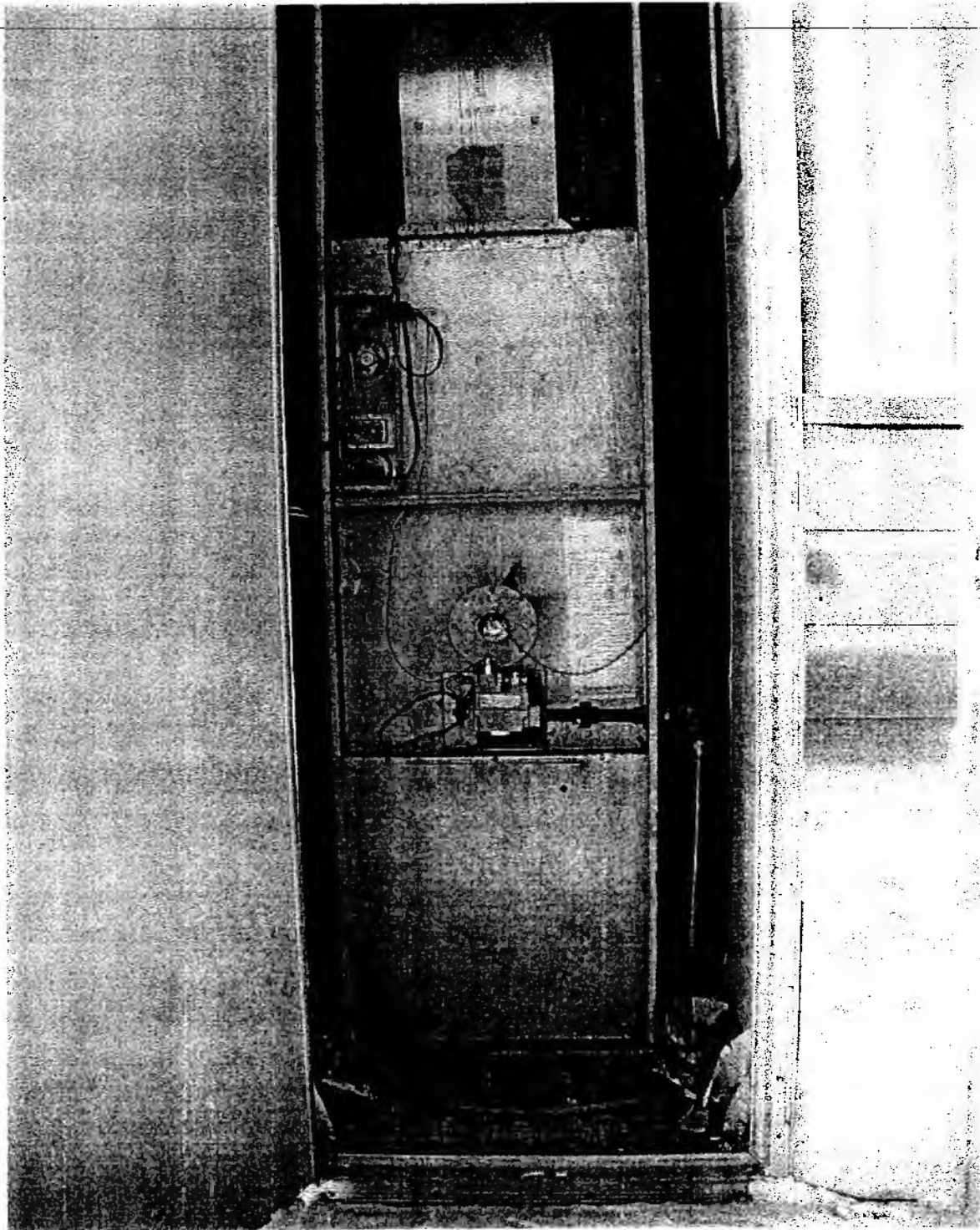
Water Heater – Propane Gas Fired - Serious Backdrafting



1202 Motor Inn

Building B

Furnace Room – Propane Gas Furnace



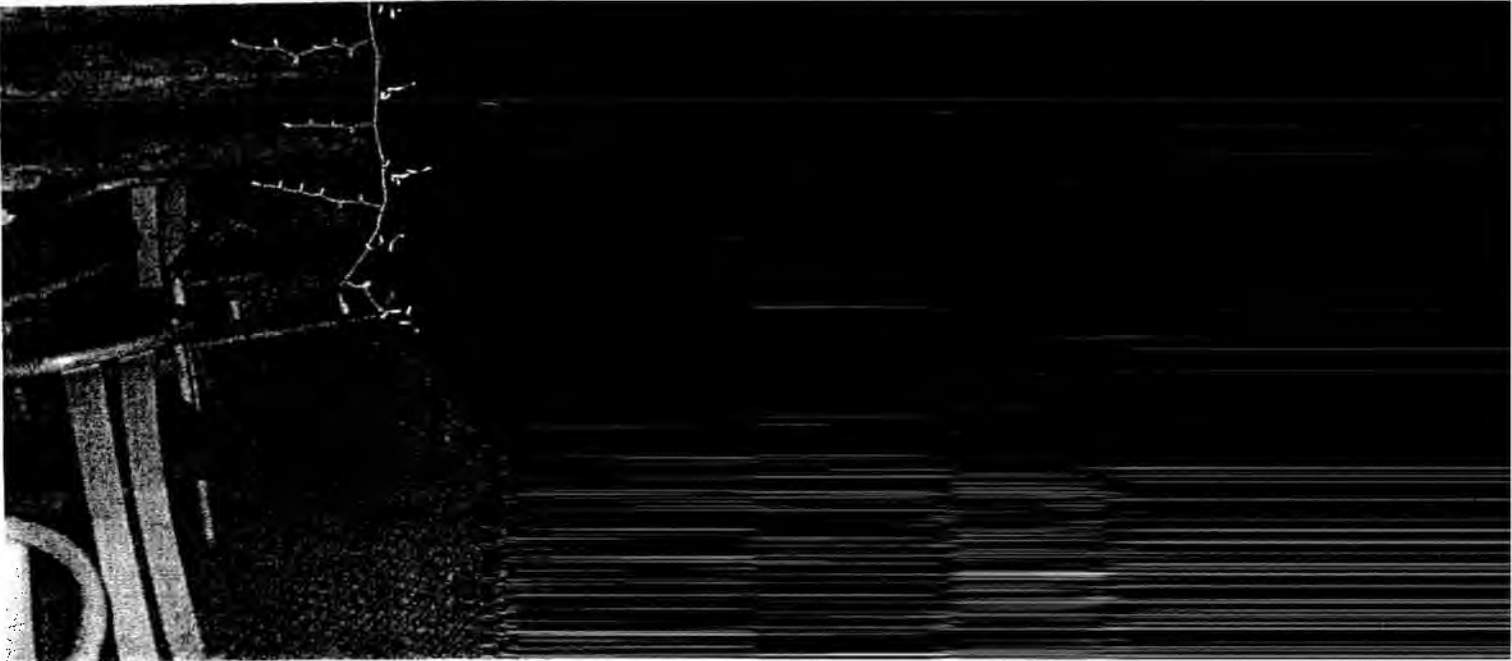
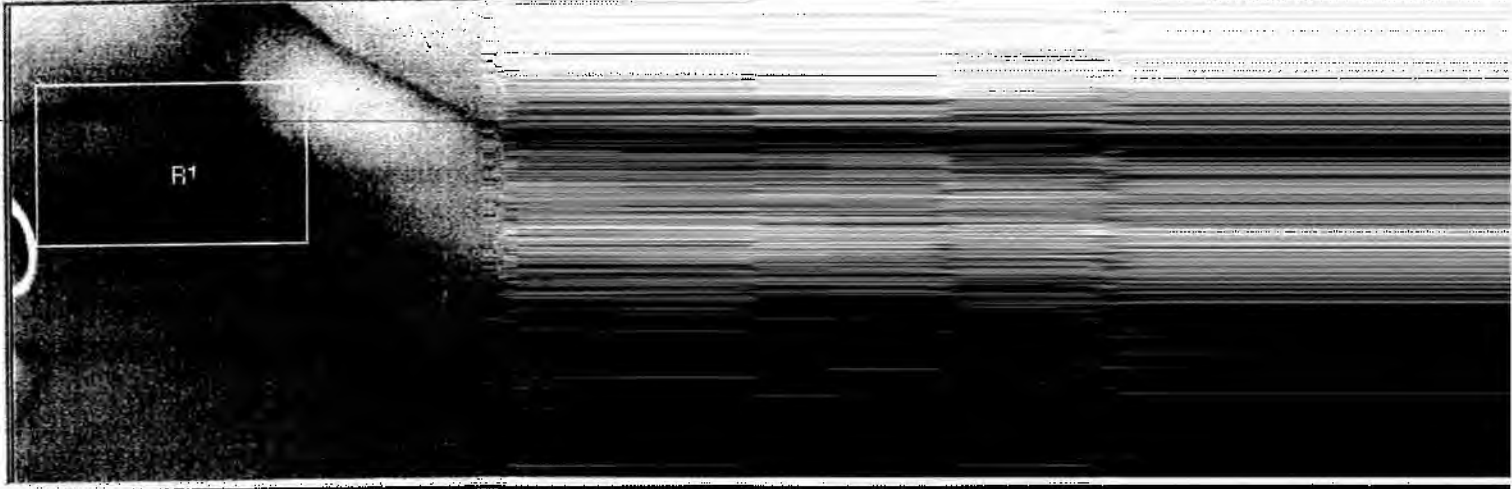
APPENDIX C

1202 MOTOR INN - INFRARED IMAGES AND PHOTOS:

**LODGE AND RESTAURANT
BUILDING A - ROOM #8
BUILDING B - ROOM #24
BUILDING C - GENERAL AREAS**

BT-01 - October 15, 2001
101 Mile Motor Inn-Beaver Creek,
Location: Lounge - NE Corner @ E

IMG001.ANA: Image1

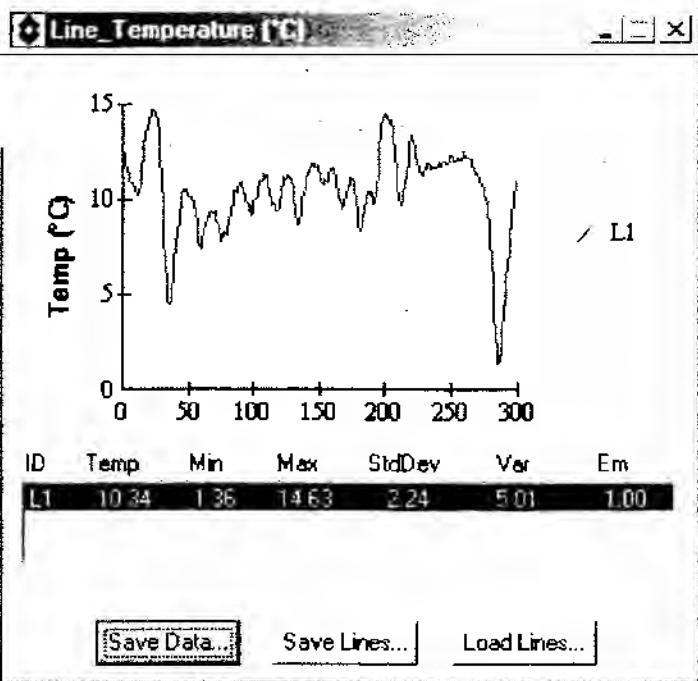


BT-02 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

Location: Lounge - NE Corner @ Ceiling

This image of the lounge ceiling shows the difficulty presented in sealing air leaks typical of log construction. Being diffuse and wide spread increases the challenge. Weatherall and Permachink are two products providing solutions for log building air sealing.



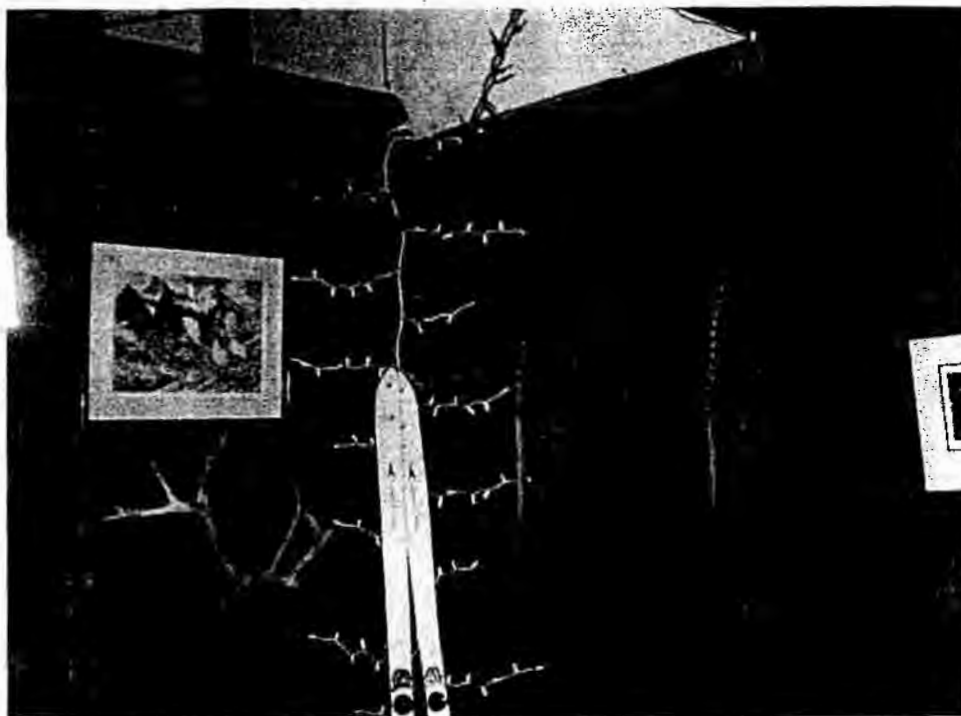
BT-03 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Lounge - NW Corner @ Upper Wall



The analysis box F1 indicates temperatures as low as -9.1C and as high as 14.8C. Room air temperatures were at 16.5C when the image was taken. The area where log and framing meet appears to be comparatively warm.

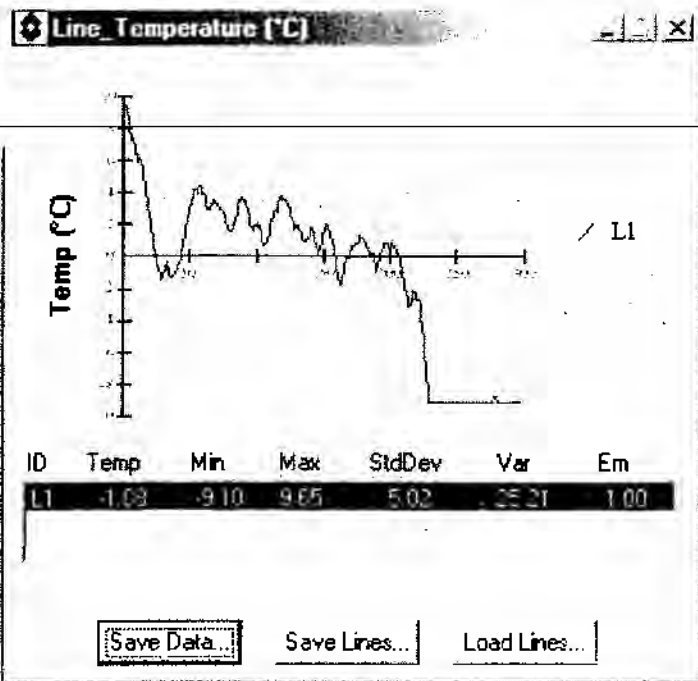
Area Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
F1	9.41	-9.10	14.82	3.64	1.3e+001	1.00

Save Data... Save Areas... Load Areas...



BT-04 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Lounge - NW Wall @ Floor

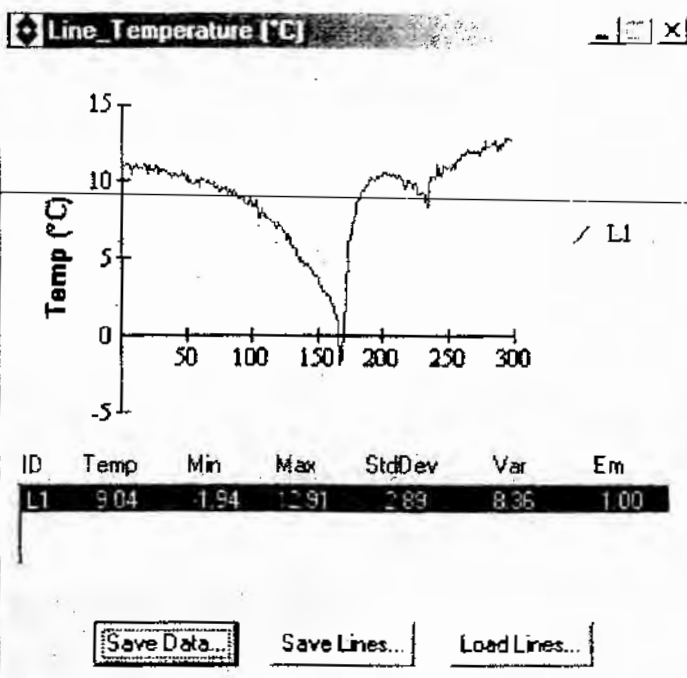
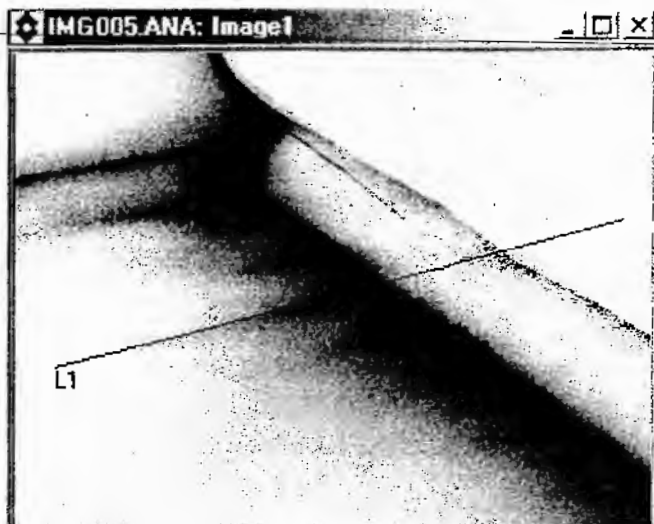
Sill areas at the log wall / floor connections were found to be areas with high air leakage. Caulking this joint will greatly reduce the infiltration of cold outside air.



Missing Picture of West wall in dining room

BT-05 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Dining - NW Corner @ Floor

Another example of log wall to floor air leakage.



BT-06 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Dining - Upper NW Corner @ Top



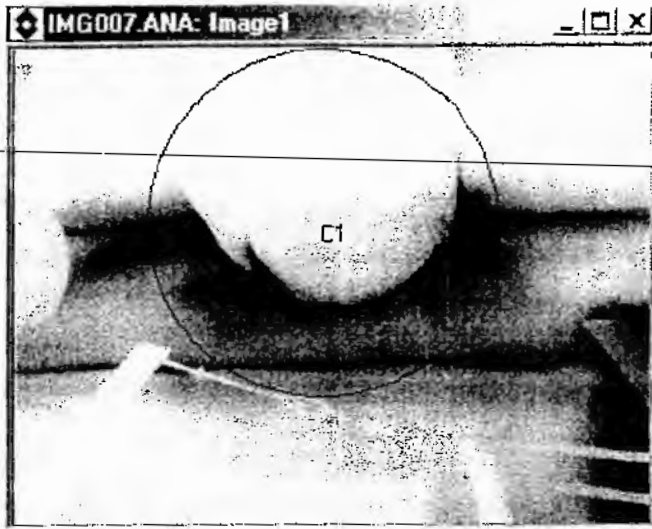
This picture is a good example of cold outside air entering through cracks at an outside corner, cooling the log surfaces. Cold air temperatures outside, result in cold inside surface temperatures.

Area Temperature (°C)						
ID	MeanT	Min	Max	StdDev	Var	Em
C1	10.75	-6.95	17.75	4.70	2.2e+001	1.00

Save Data... Save Areas... Load Areas...



BT-07 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Dining - Log Beam Penetration @ West Wall



All building thermograms were taken with the blower door operating. Placing the buildings under a negative pressure served to exaggerate the air leakage rate and make individual leak locations more visible.

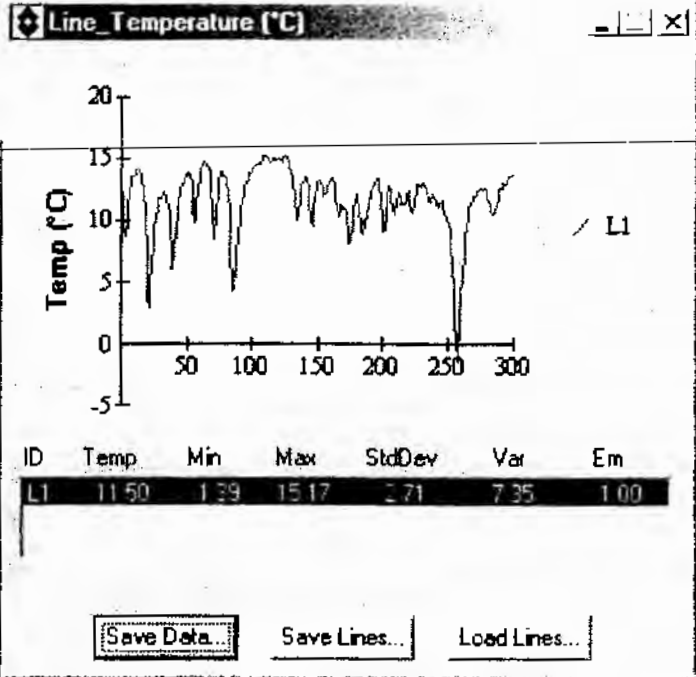
Area_Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
C1	13.38	-9.10	17.64	3.81	1.5e+001	1.00

Save Data... Save Areas... Load Areas...



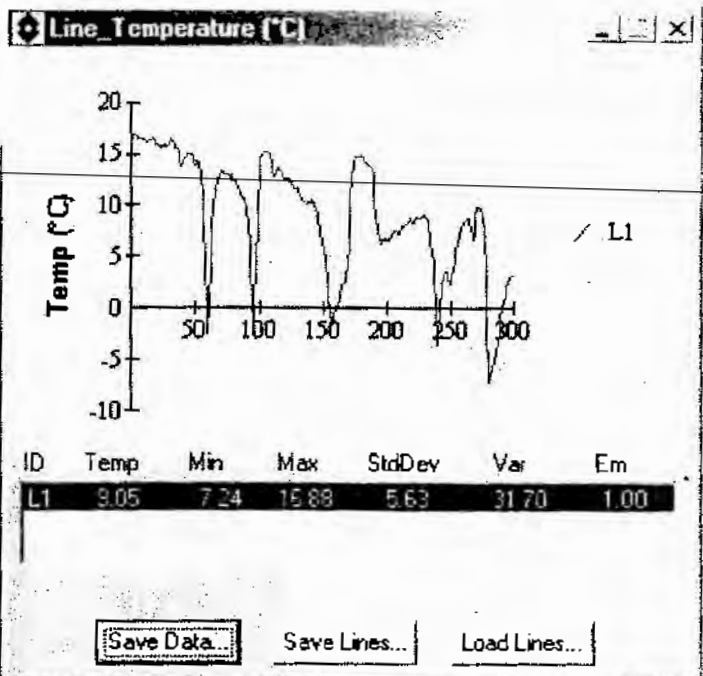
BT-08 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Dining - West Wall @ 2nd Floor Intersection

Second floor construction shows similar leak patterns as the sill plates. Here, the T&G planks are leaking at their joints.



BT-09 - October 15, 2001
 101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
 Location: Store - South Wall @ West Wall Corner

The building had been under negative pressure for about one half hour when this image was captured. Air is seen leaking everywhere.



BT-10 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

Location: Store - South Wall @ Log Beam Penetrations



Log beams are difficult to seal where they penetrate outside support walls.

Using a product such as Weatherall or Permachink can substantially reduce such leakage.

Area_Temperature (°C)

ID	MeanT	Min	Max	StdDev	Var	Em
C1	10.39	-9.10	17.58	6.06	3.7e+001	1.00
C2	11.32	-9.10	18.02	5.22	2.7e+001	1.00

Save Data...

Save Areas...

Load Areas...

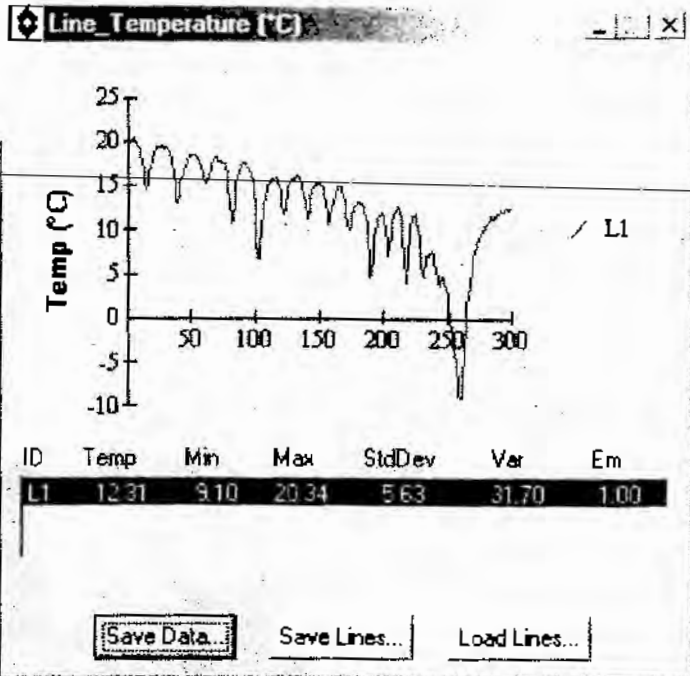


BT-11- October 15, 2001

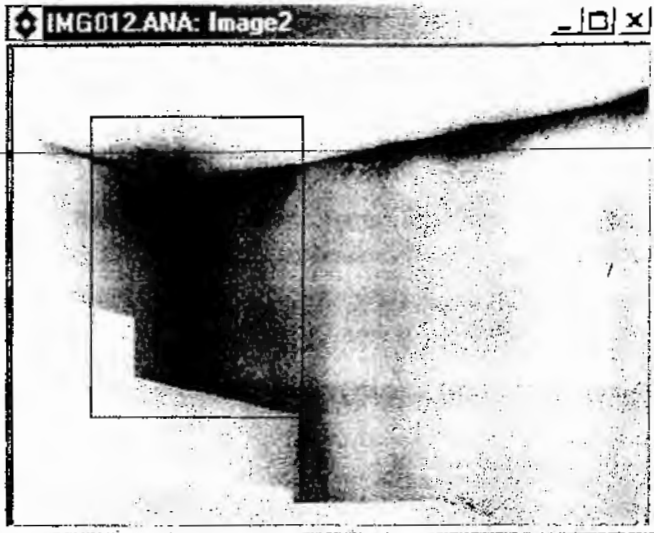
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

Location: Store - Wall Above Coolers @ 2nd Floor Intersection

Another view of T&G decking leaking air at the joints between planks. The second floor is constructed above these boards.



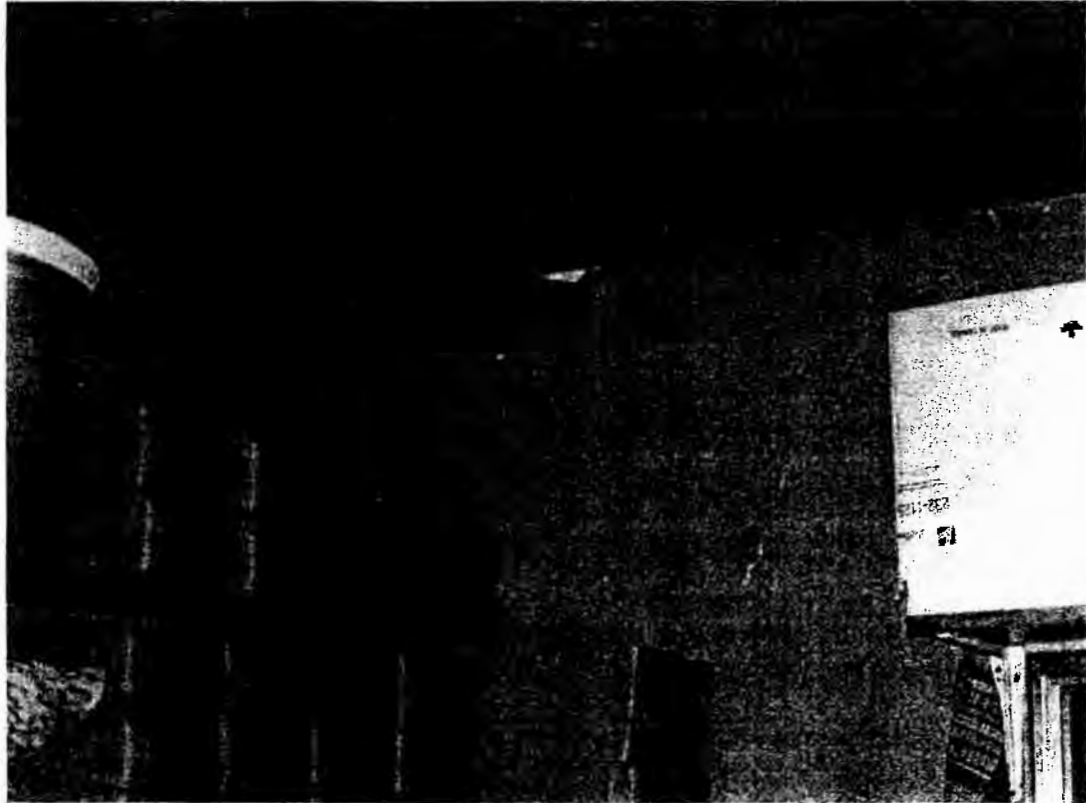
BT-12 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Main Lodge
Location: Pantry @ Interior Wall Intersection



Interior wall intersections typically leak because the air vapor barrier was not installed in a continuous manner. A properly applied exterior retrofit would practically eliminate all air leakage such as this.

ID	MeanT	Min	Max	StdDev	Var	Em
R1	9.28	-7.86	14.65	3.44	1.2e+001	1.00

Save Data... Save Areas... Load Areas...



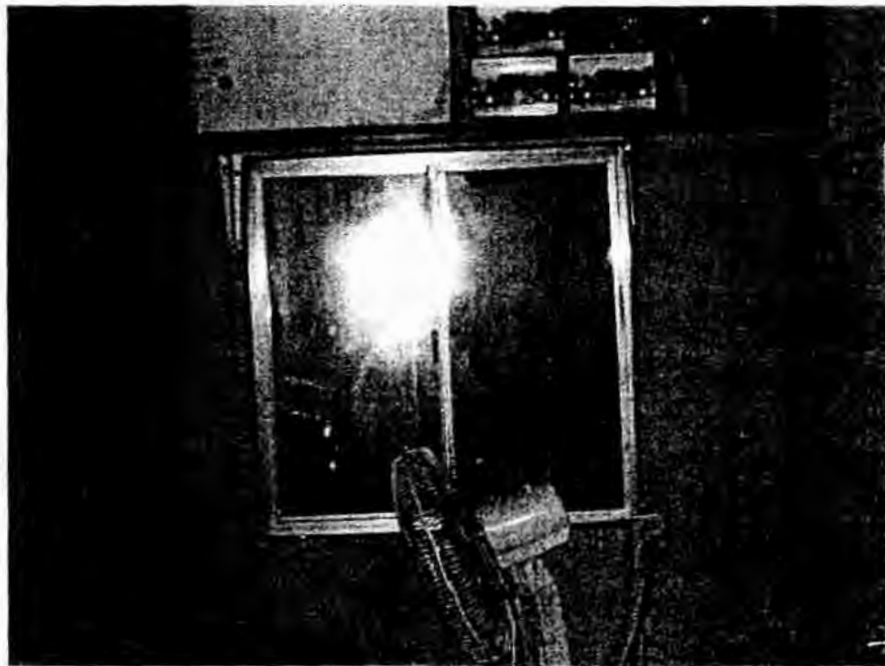
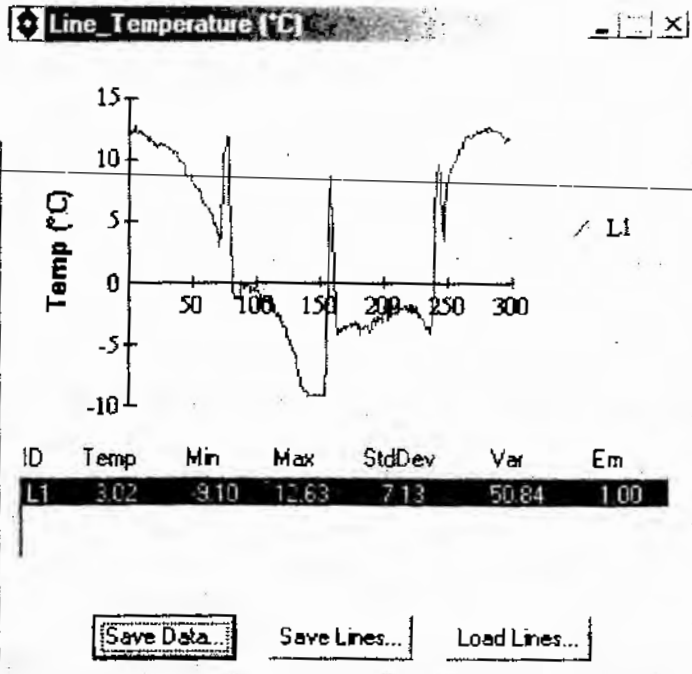
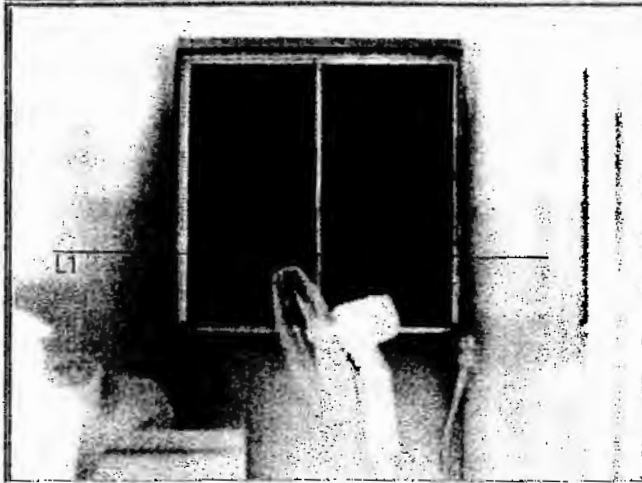
BT-13 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

Location: Pantry @ Middle Room Window

This window frame is made from aluminum. Because of its high conductive properties, aluminum windows should not be used.

IMG013.ANA: Image1



In addition to being constructed of highly conductive aluminum, this window slides to open. Sliding windows can be built to very tight air leakage standards, but with use, they often leak much more than designs which allow for a gasket compression type of seal.

Casement and tilt/turn type operating windows seem to maintain their air-tight qualities far longer than sliding designs.

Aluminum sliders are the worst windows for cold climates.

BT-14 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

Location: Bathroom #2 @ Partition Wall Intersection



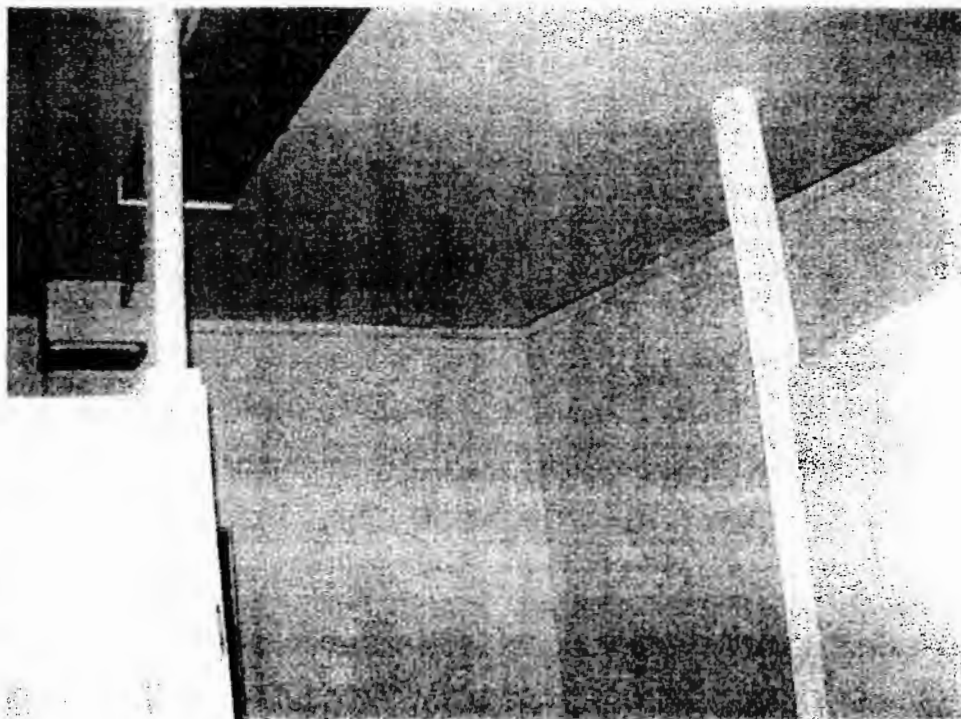
This image shows problems at the ceiling and corners. Insulation located in the ceiling was not properly installed, or has moved due to building movement/shipping. The temperature at the surface is barely above freezing.

Area_Temperature [°C]

ID	MeanT	Min	Max	StdDev	Var	Em
R1	10.94	0.15	14.60	1.75	3.0e+000	1.00

Save Data... Save Areas... Load Areas...

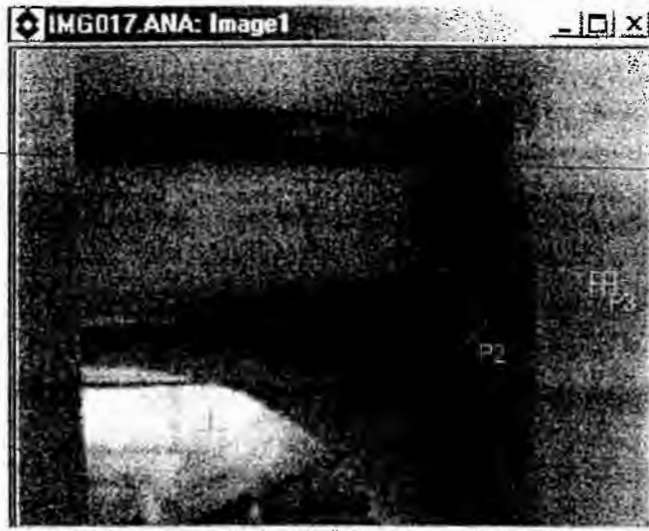
An "Area_Temperature [°C]" window displaying a table of temperature data for a specific area (R1). The table includes columns for ID, MeanT, Min, Max, StdDev, Var, and Em. Below the table are three buttons: "Save Data...", "Save Areas...", and "Load Areas...".



BT-15 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

Location: Bath Hall @ Upper Wall Log / Frame Joint



Stick frame to log joints are some of the more difficult areas to seal air tight. Here we find cold air easily entering due to the uneven surfaces. Sealing from the inside is the only option.

ID	Temp	Xpos	Ypos	Em
P1	19.27	99.0	49.0	1.00
P2	9.29	231.0	97.0	1.00
P3	17.23	296.0	123.0	1.00

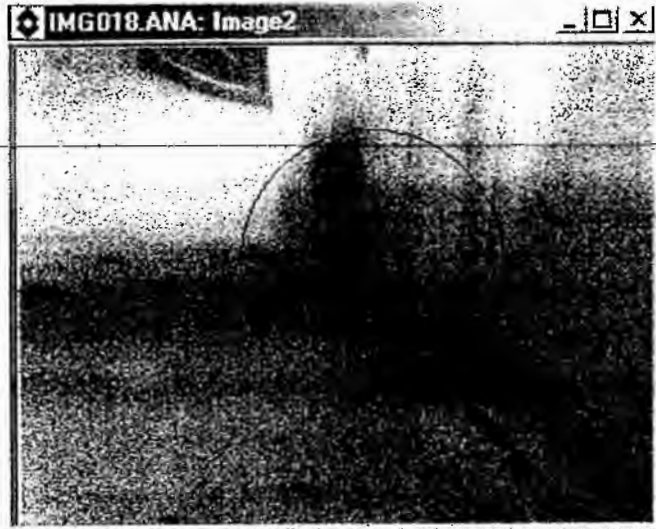
Save Data... Save Points... Load Points...



BT-16 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Main Lodge

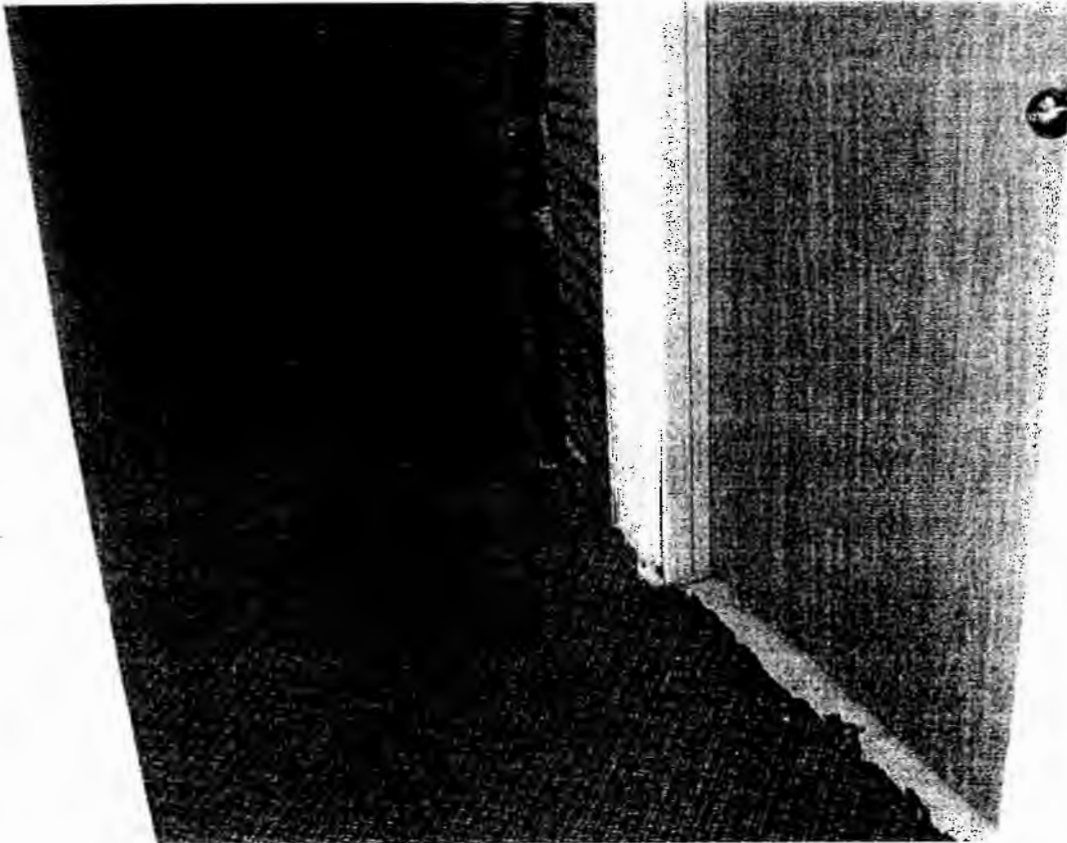
Location: Bath Hall @ Lower Wall Log / Frame Joint



The same area shown in the previous image is illustrated here, only at the bottom of the joint. We found a warmer infiltrating air temperature and believe it is due to air coming from the crawlspace. Question: is crawlspace air good, clean, healthy air?

Area_Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
C1	13.73	10.73	15.51	0.75	5.6e-001	1.00

Save Data... Save Areas... Load Areas...



BT-17 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building A, Room 8

Location: Outside Corner @ Upper Wall



These buildings are pre-fabricated at a plant and then transported to the site. Construction details are such that a duplicating dimensions and appearance are consistent. Likewise, errors in construction are also consistent.

ID	MeanT	Min	Max	StdDev	Var	Em
R1	6.91	-5.42	12.02	4.21	1.8e+001	1.00
R2	8.24	0.04	11.58	2.19	4.8e+000	1.00
R3	10.16	-3.52	14.60	2.84	8.0e+000	1.00

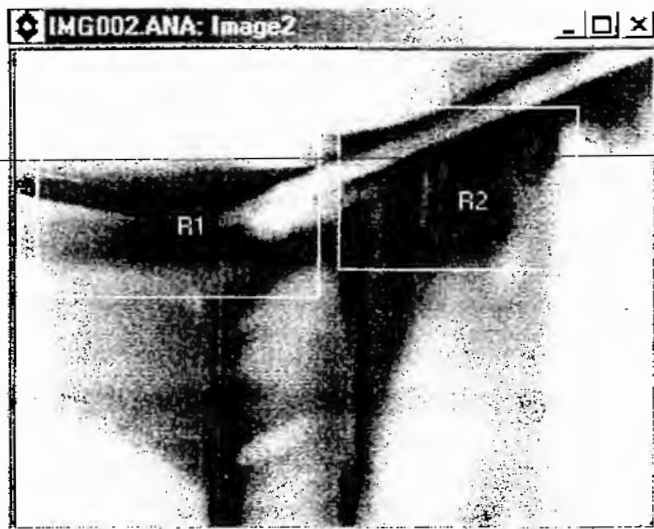
Save Data... Save Areas... Load Areas...

Missing picture for this thermogram of Building A Room #8.

BT-18 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building A, Room 8

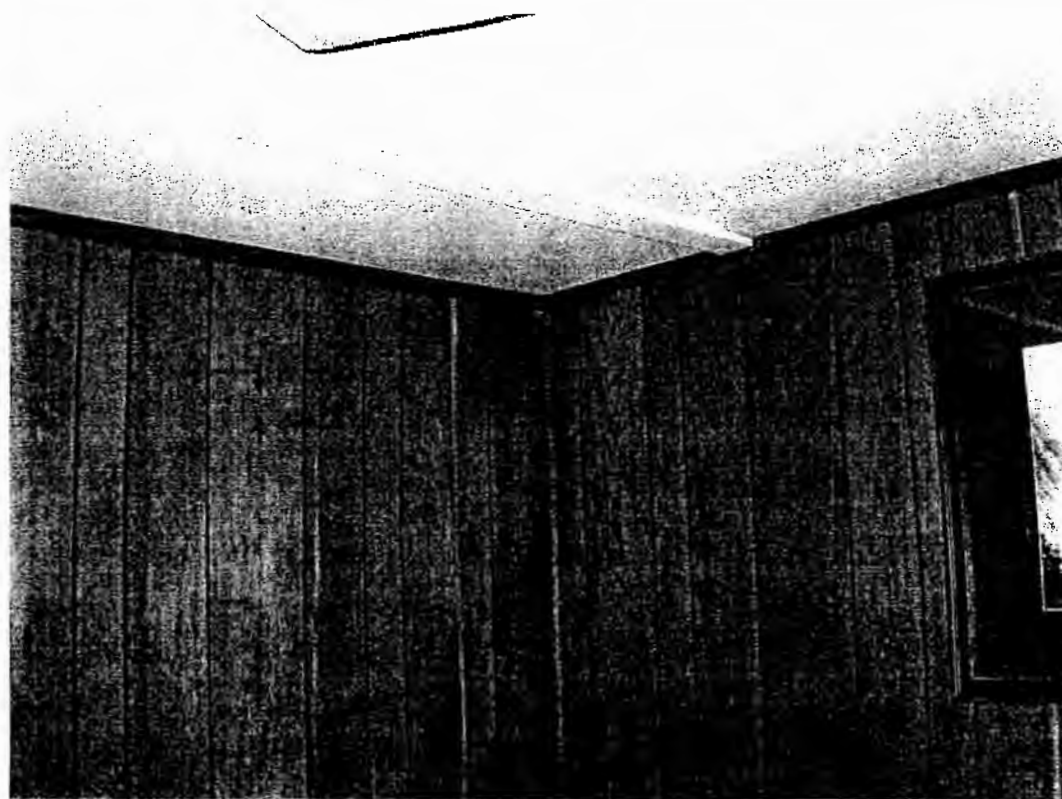
Location: Outside Corner @ Upper Wall



This manufactured housing shows air leakage at almost every intersection and corner. The only practical way for air sealing is on the exterior as the buildings are quite limited in interior space. Wrapping with an AVB and insulating the outside is one approach.

ID	MeanT	Min	Max	StdDev	Var	Em
R1	9.19	0.75	13.34	2.17	4.7e+000	1.00
R2	8.29	-0.67	13.91	2.19	4.8e+000	1.00

Save Data... Save Areas... Load Areas...



BT-19 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, Y

Location: Outside Corner @ Upper

- Building A, Room 8

all

IMG003.ANA: Image3



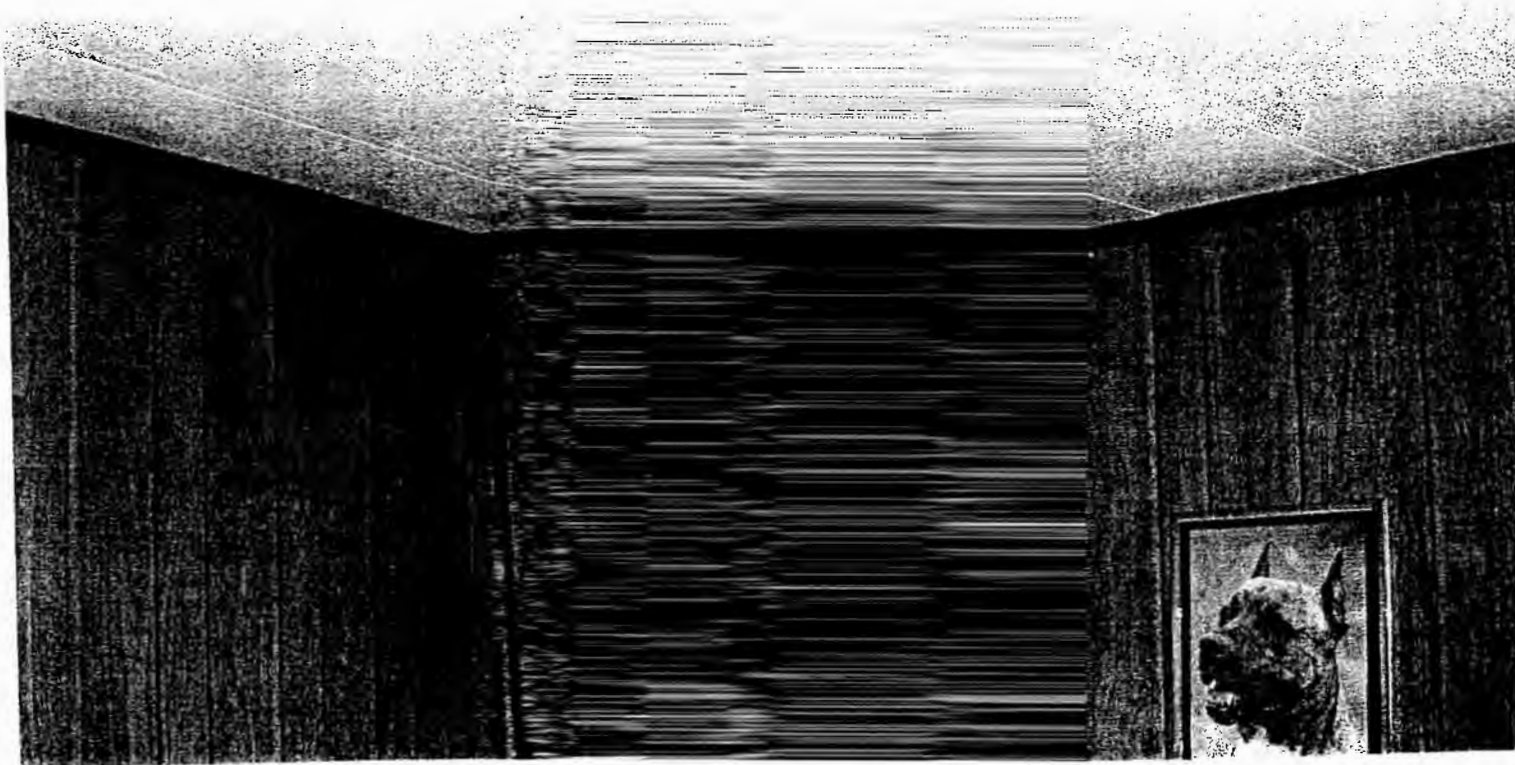
This image shows 1
intersecting partic

In each of the anal
R3, surface temper
freezing.

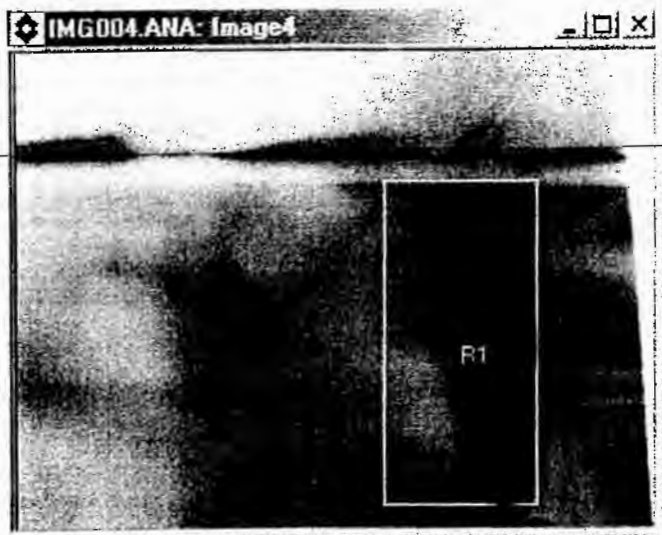
Area_Temperature (°C)

ID	MeanT	Min	M
R1	6.06	-9.10	1
R2	7.38	-5.52	1
R3	6.92	-9.10	1

Save Data...



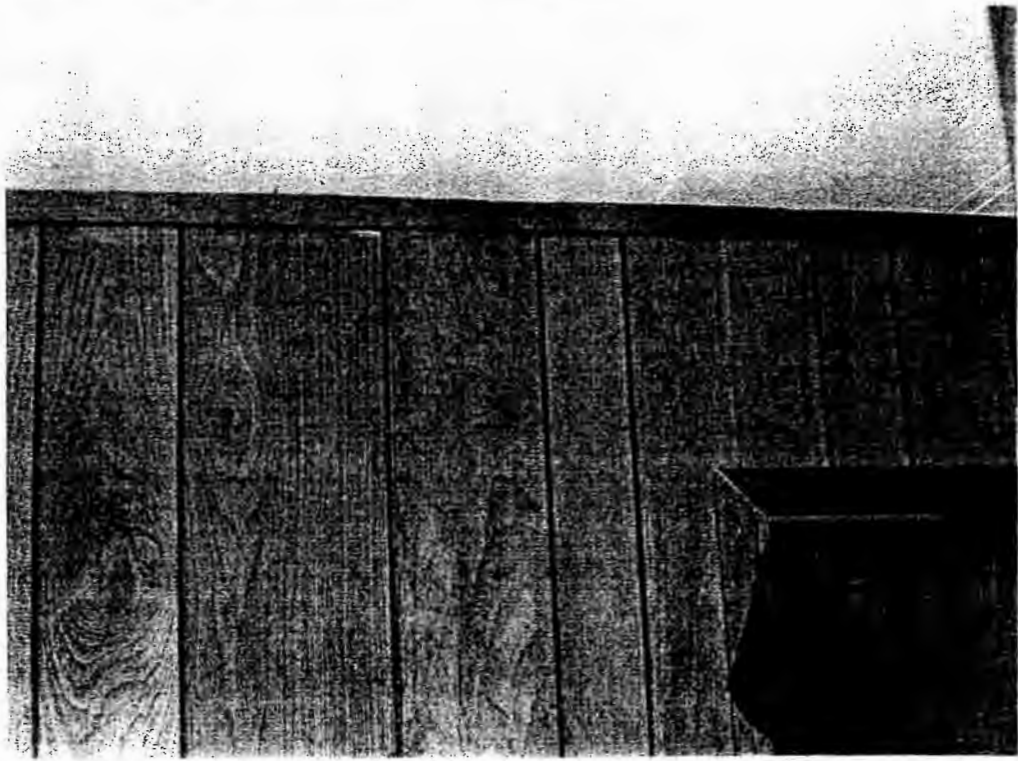
BT-20 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building A, Room 8
Location: Door Installation @ Upper South Wall



ID	MeanT	Min	Max	StdDev	Var	Em
R1	3.04	-9.10	9.56	3.26	1.1e+001	1.00

Save Data... Save Areas... Load Areas...

The appearance of this anomaly is usually from two deficiencies: Missing or improperly installed insulation and air leakage. Correcting it from the interior without disrupting the owners' ability to continue doing business is difficult.

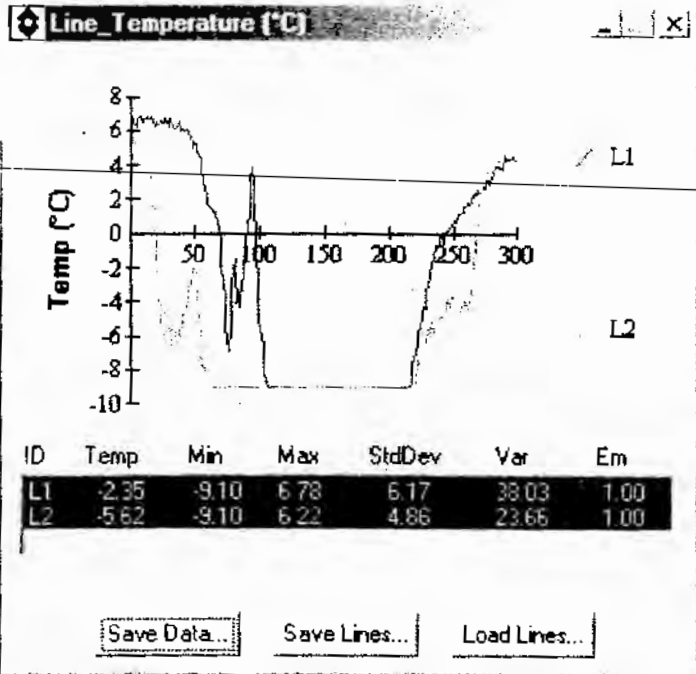


BT-21 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building A, Room 8

Location: Bathroom @ Ceiling Exhaust Fan

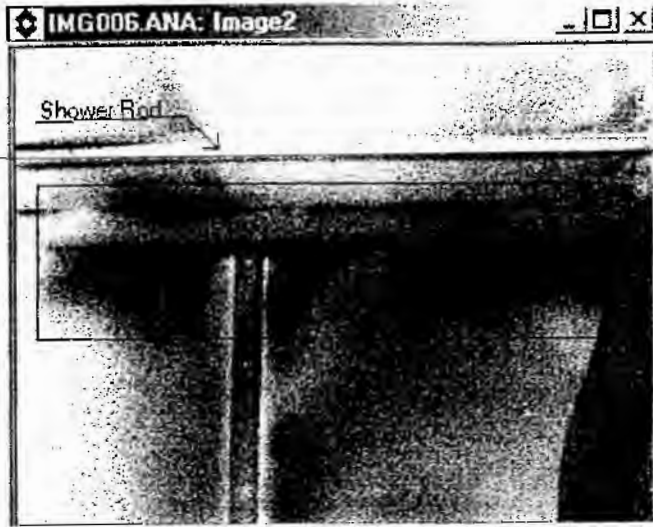
We found air to be able to exit, or enter, the building freely. No damper was installed.



BT-22 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building A, Room 8

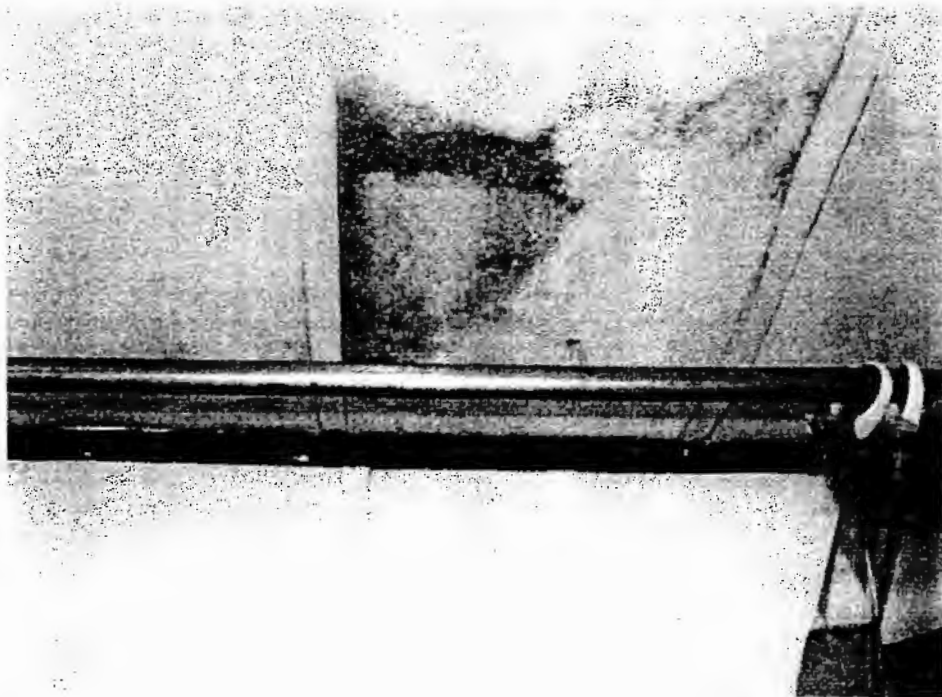
Location: Bathroom Ceiling @ Tub / Shower Wall



Stained ceiling panels represent years of moist air condensing and then dripping back in. The harmful effects of mold spores has been identified and exist in many moisture related building defects. This stain is possible evidence that one such defect is present in this unit.

Area Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
R1	2.44	-3.33	5.32	1.08	1.2e+000	1.00

Save Data... Save Areas... Load Areas...



BT-23 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building A, Room 8

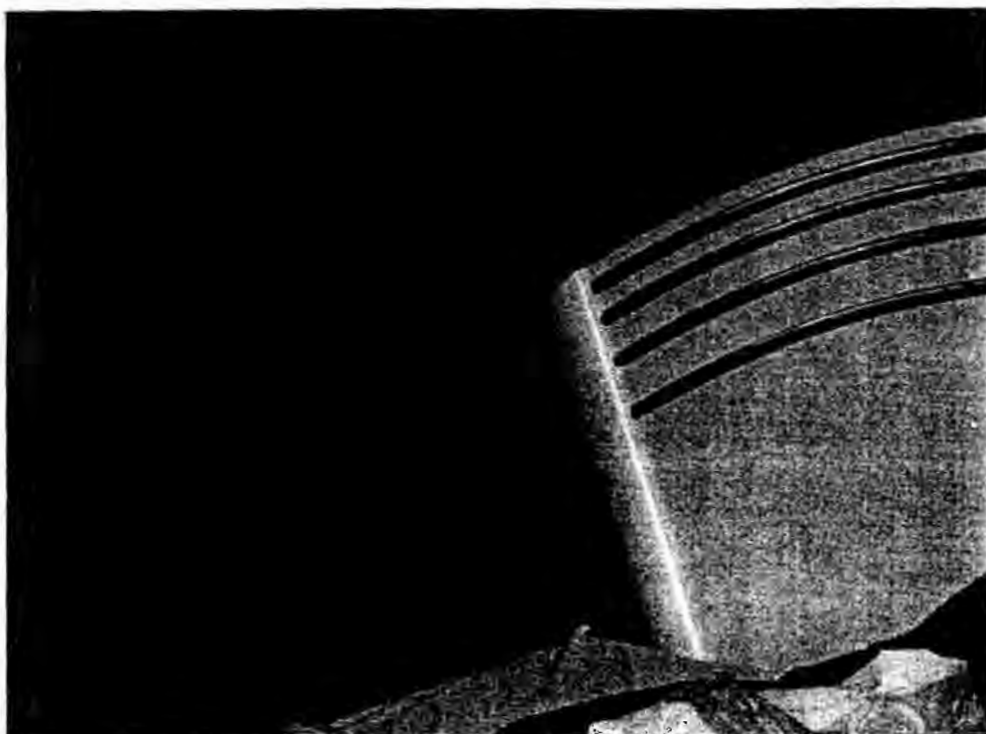
Location: Outside Corner @ Bedroom



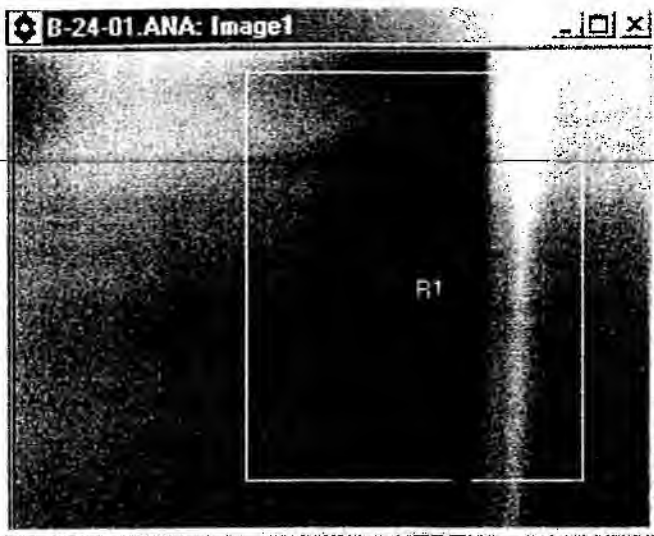
Again we found air entering at an interior partition connection with the exterior wall. Temperatures below freezing were commonplace. As important as energy reduction is the comfort of the occupants. Sleeping comfortably could be a challenge.

Area Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em .
R1	4.38	-9.10	11.42	5.24	2.8e+001	1.00

Save Data... Save Areas... Load Areas...



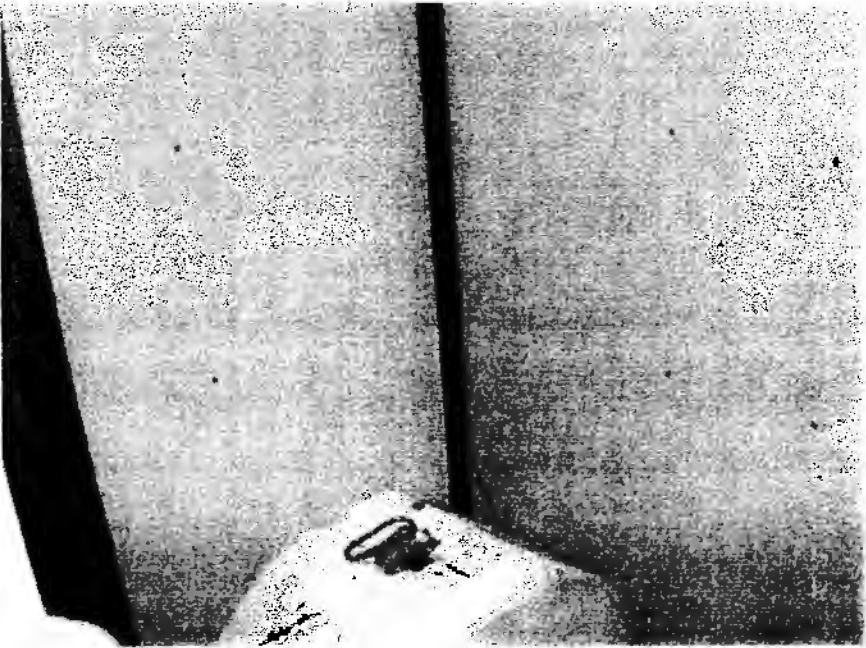
BT-24 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24
Location: Closet Corner @ Outside Wall



The other side of this interior partition contains the domestic water heater, yet entering air temperatures were well below that of the room. The door to the water heater was damaged and extremely leaky causing the heater to cycle frequently even though no water was being used.

ID	MeanT	Min	Max	StdDev	Var	Em
R1	14.13	9.23	18.56	1.63	2.7e+000	1.00

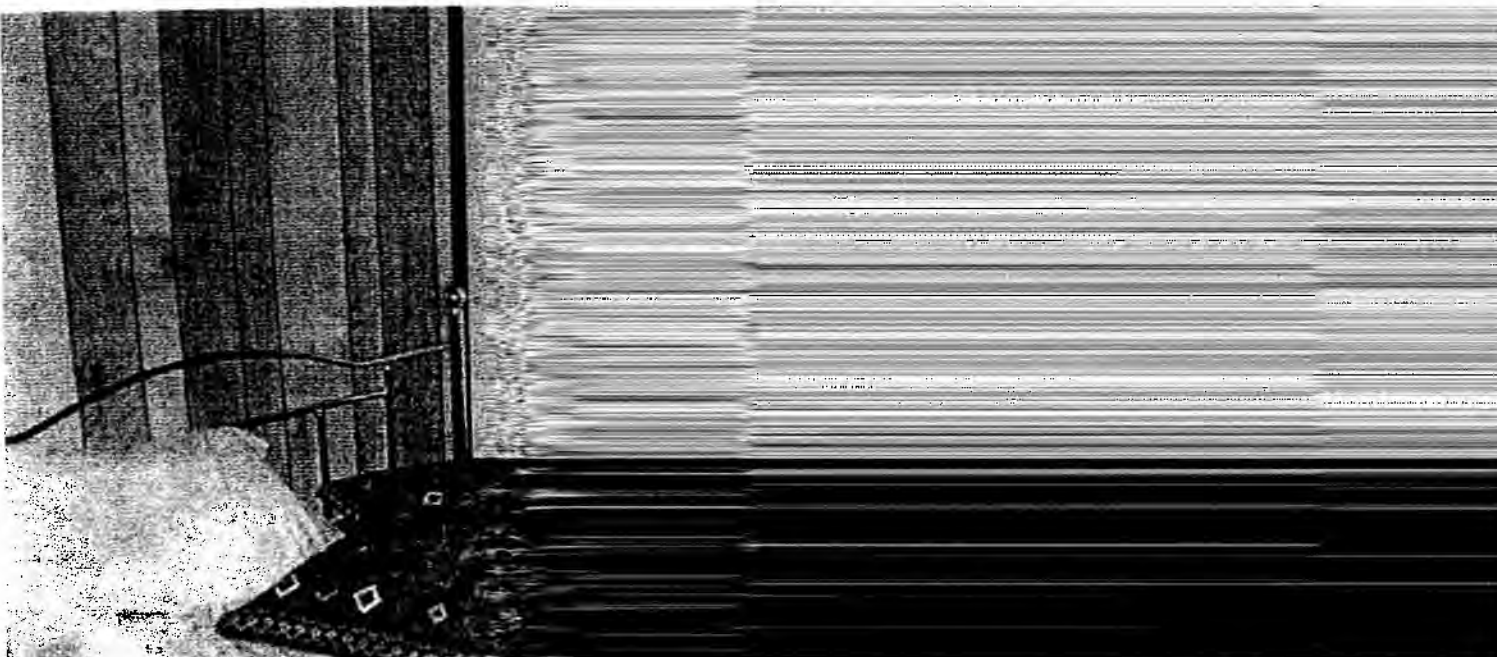
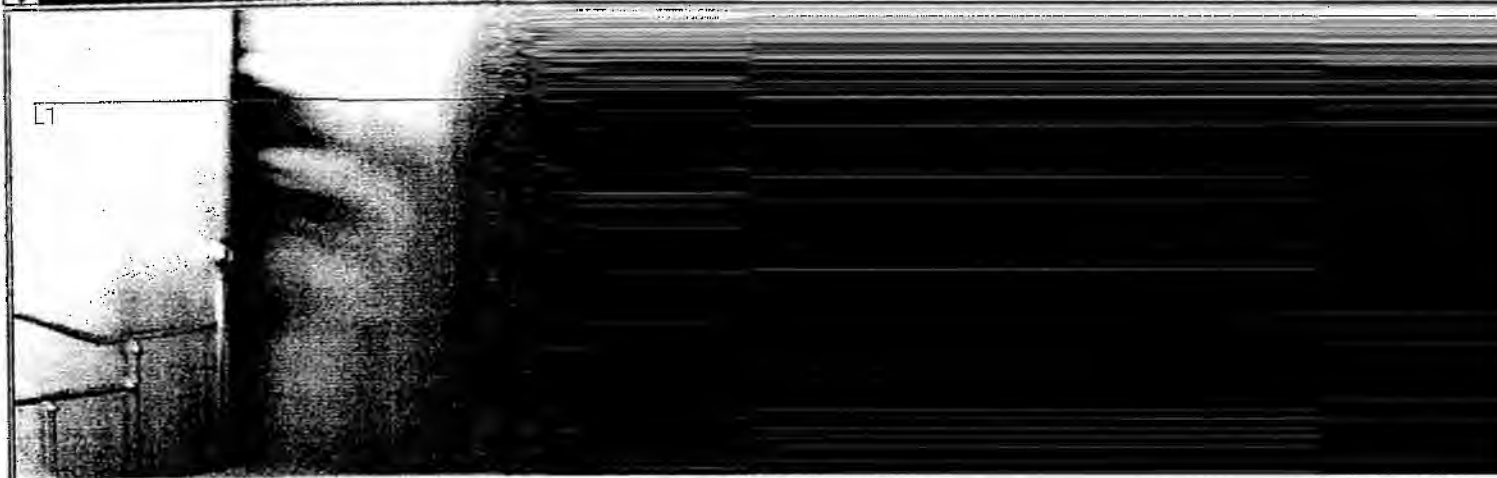
Save Data... Save Areas... Load Areas...



BT-25 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, ~~XXXX~~
Location: Interior Partition Corner

The "feathered" look is from air leak
the "mottled" appearance comes typi
improper or missing insulation. Both

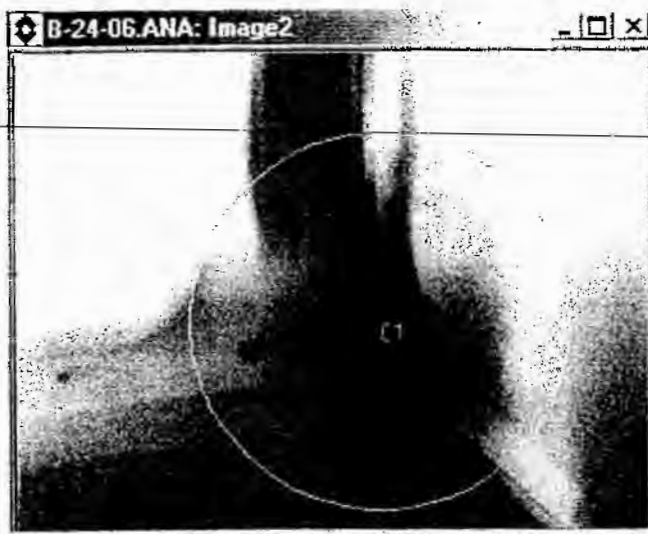
B-24-03 ANA: Image3



BT-28 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24

Location: Outside Corner @ Tub / Shower Surround



While the water may be hot, the tub / shower surround is cold, very cold. Most likely the result of air leaking behind the fiberglass surround the comfort of occupants and durability of the building are being compromised.

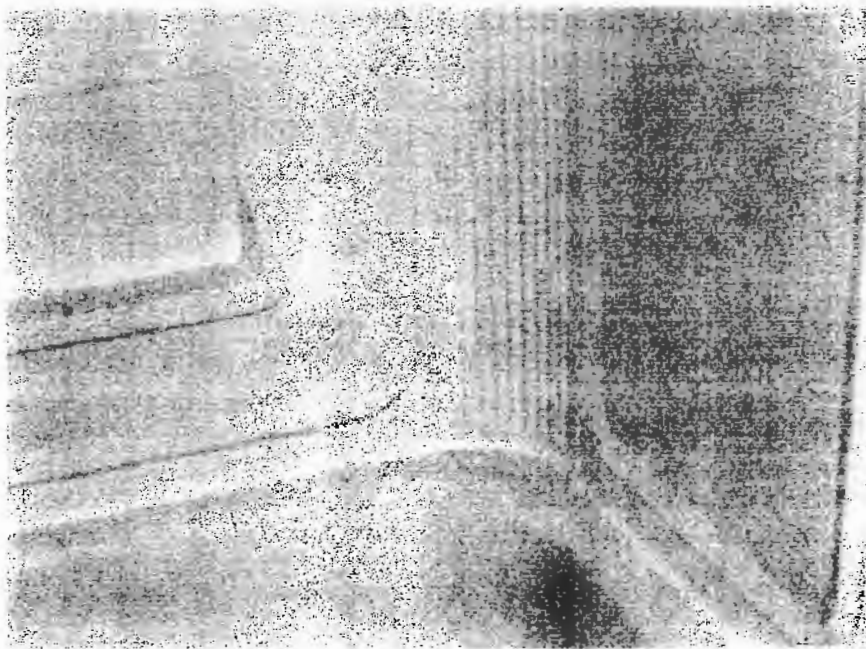
Area_Temperature (°C)

ID	MeanT	Min	Max	StdDev	Var	Em
C1	9.53	2.35	14.36	2.54	6.5e+000	1.00

Save Data...

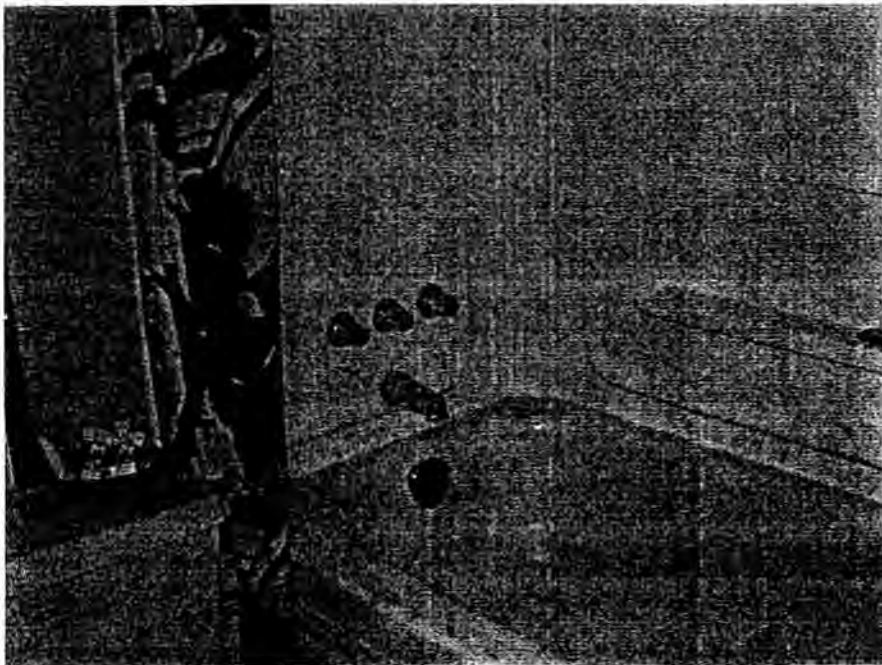
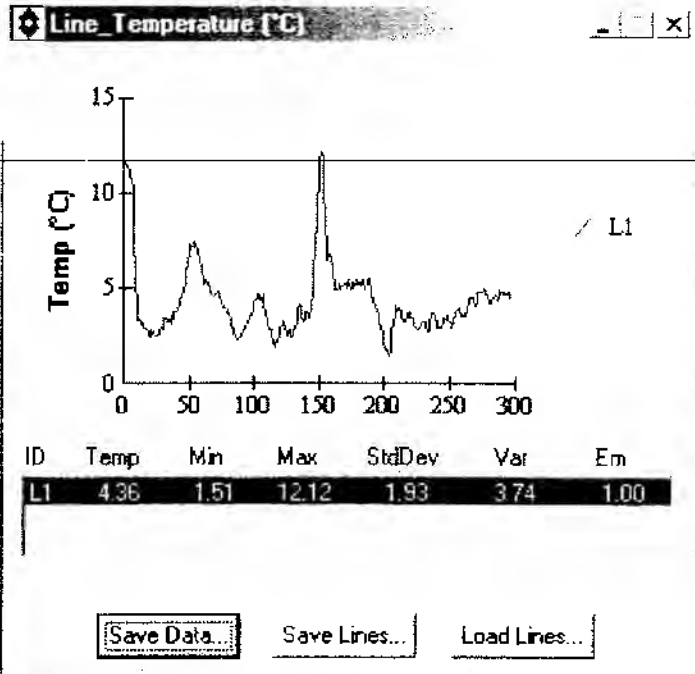
Save Areas...

Load Areas...



BT-29 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24
Location: Bathroom @ Bathtub Fixtures

Another look a the bathtub. Cold air is blasting in from behind the plumbing fixtures. This could be make-up air for the exhaust fan.

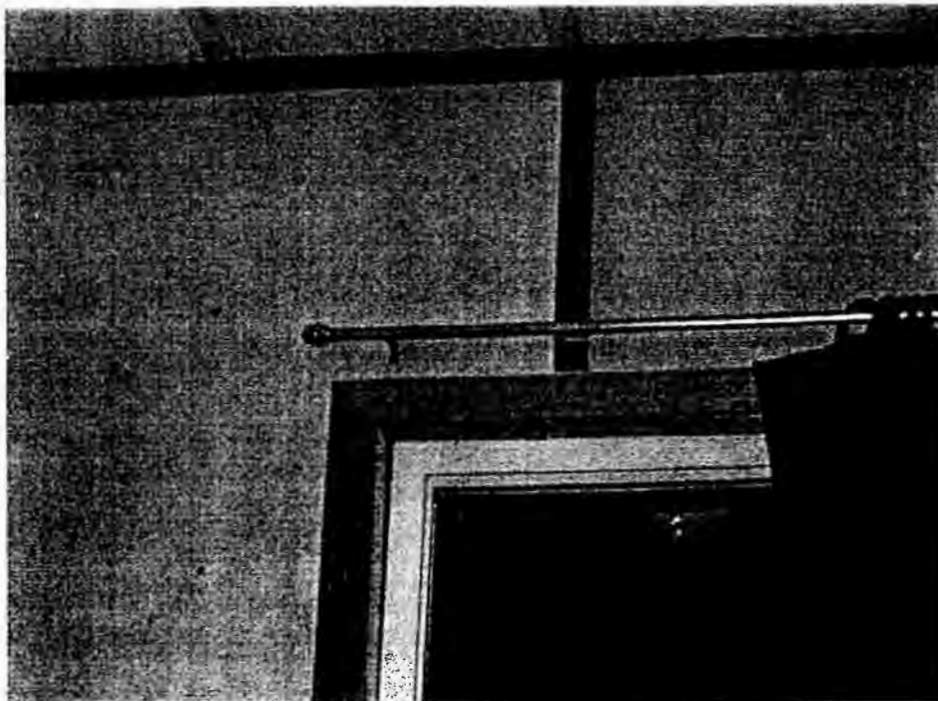
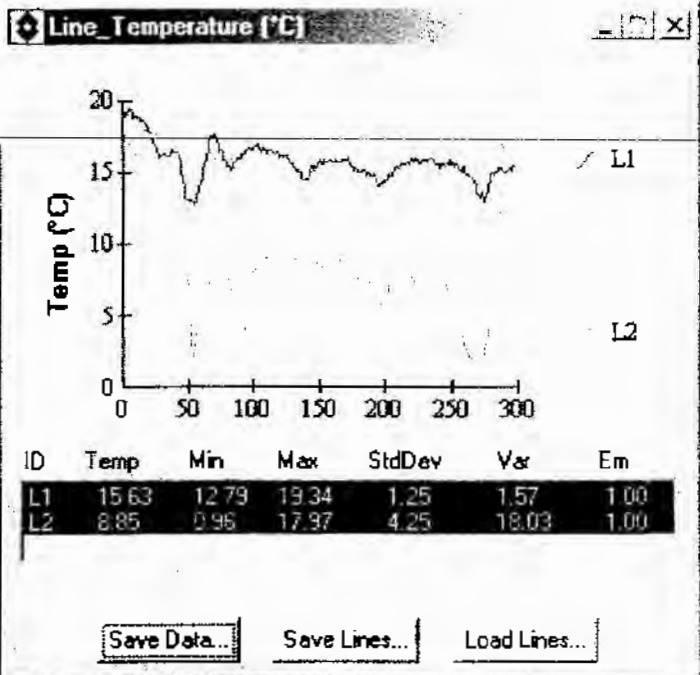
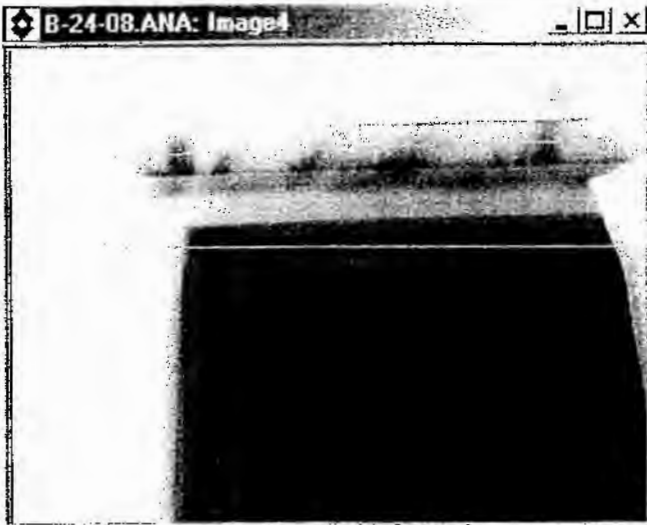


BT-30 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24

Location: Living Room @ Upper Wall / Window

A quality window is seen here with a sub-standard installation. Installation is equally important when building in cold climates.



BT-31 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24

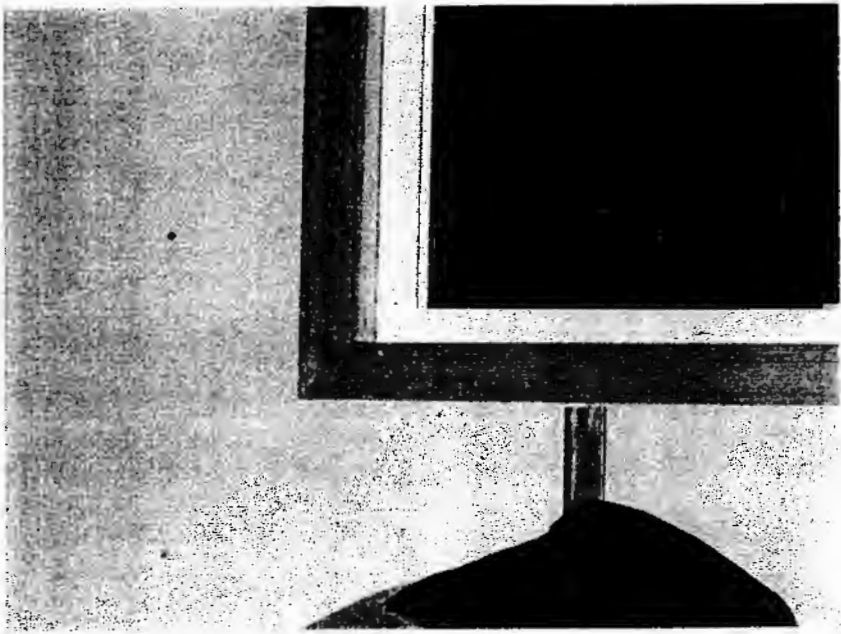
Location: Living Room @ Window Installation



Air leaking in between window frame and rough opening allow this cold spot to exist. Sealing gaps using expanded polyethylene backer rod and then caulking the surface will eliminate problem areas such as is seen here.

Area_Temperature (°C)						
ID	MeanT	Min	Max	StdDev	Var	Em
C1	5.35	-9.10	18.61	7.51	5.6e+001	1.00

Save Data... Save Areas... Load Areas...



BT-32 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24

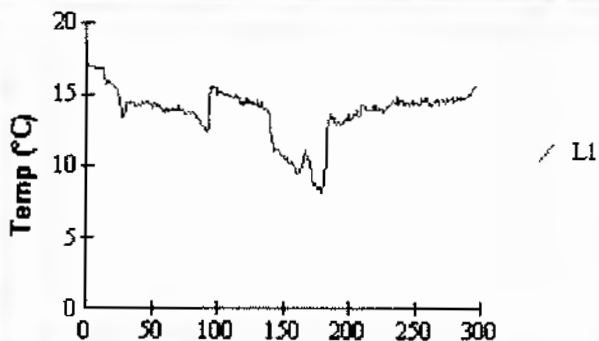
Location: Bathroom @ Interior Partition Wall & Vanity

Cold air leaking from within the vanity cabinet and from the wall behind the toilet is visible in the below thermogram. Analysis of line L1 is shown to the right. Sealing air leaks beginning with the roof and then down the exterior walls will render these leaks relatively harmless.

B-24-10.ANA: Image2



Line Temperature (*C)



ID	Temp	Min	Max	StdDev	Var	Em
L1	13.75	8.05	17.10	1.77	3.15	1.00

Save Data...

Save Lines...

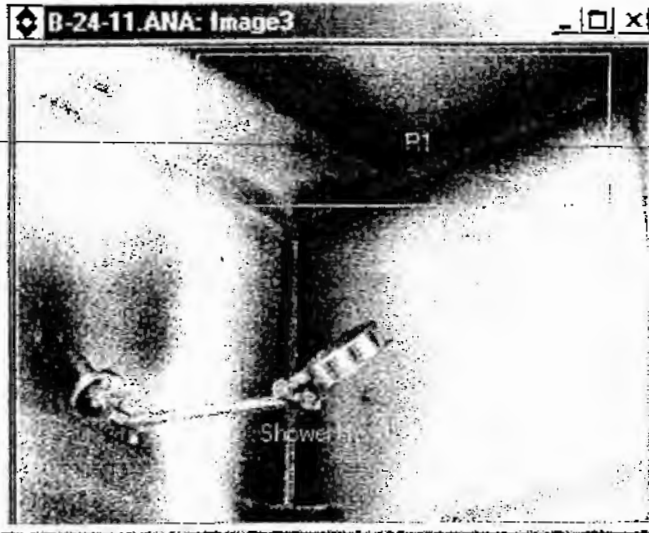
Load Lines...



BT-33 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building B, Room 24

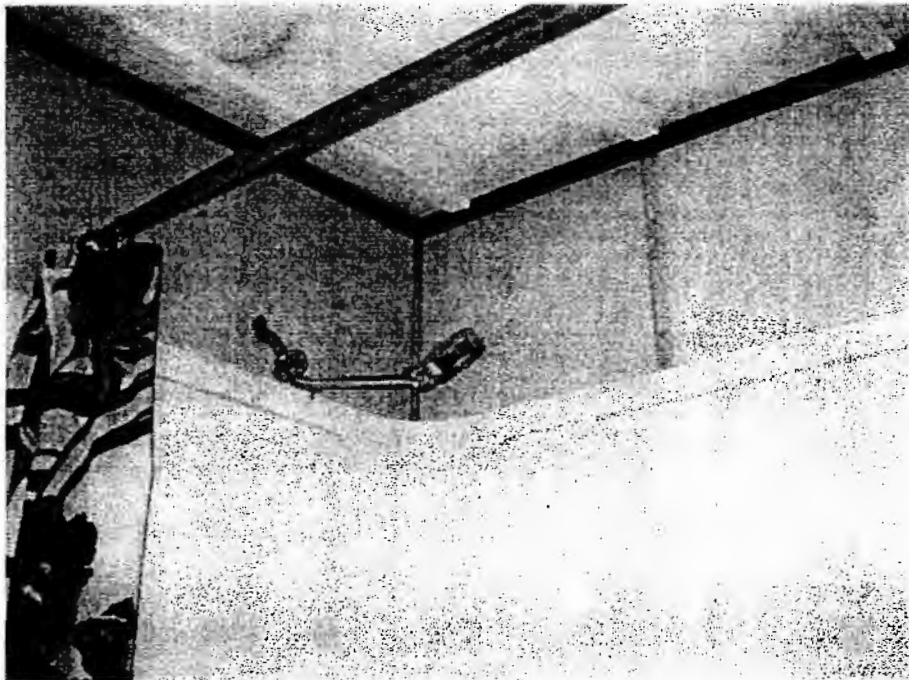
Location: Bathroom @ Shower Upper Wall



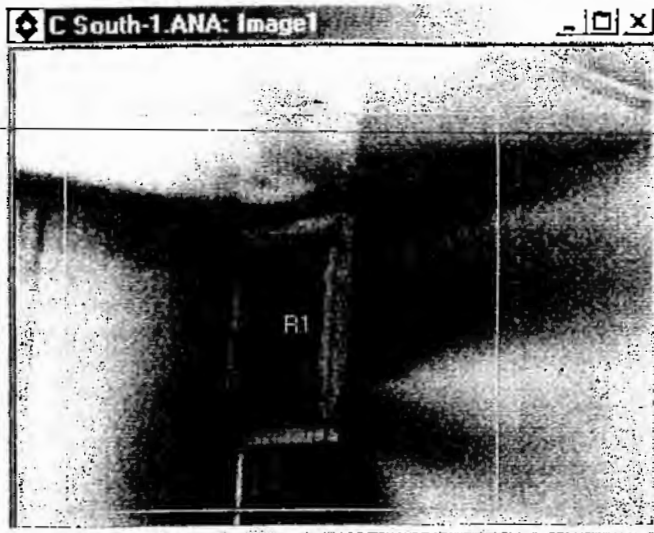
To the left is another view of a tub / shower installation showing air leaking in from behind the finished wall surface. Stains above the tub mark the areas where the dewpoint temperature occurs most frequently, causing wetting of the ceiling panels.

Area_Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
R1	12.44	5.65	15.47	1.36	1.8e+000	1.00

Save Data... Save Areas... Load Areas...



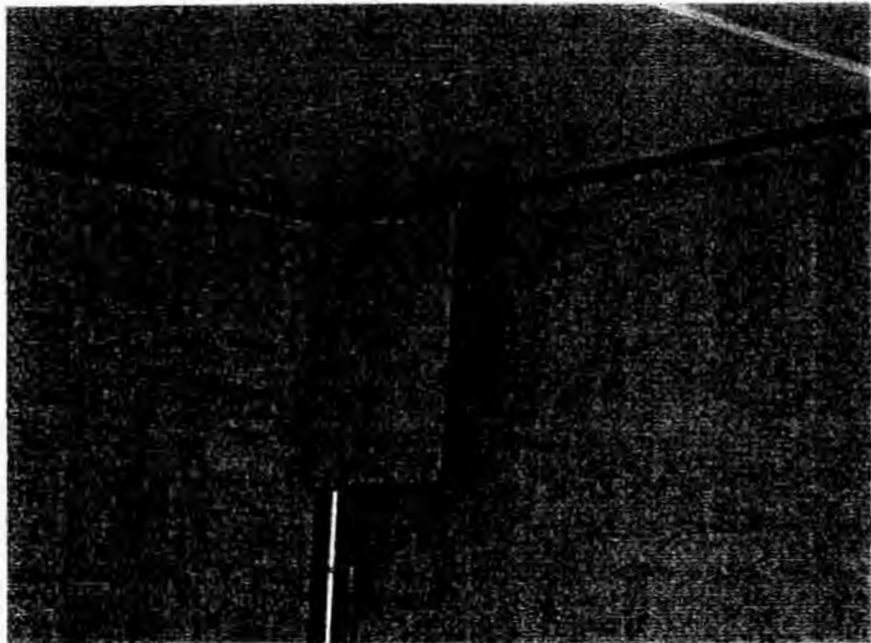
BT-34 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building C, South
Location: Electric Conduit @ Furring Box



I wasn't able to determine what was behind this wall panel but due to the electrical conduit exiting from the lower left corner I assumed it was a sub-feed connection. Regardless of it's purpose, it allows severe air leakage through the building wall component.

ID	MeanT	Min	Max	StdDev	Var	Em
R1	21.58	13.23	25.60	2.28	5.2e+000	1.00

Save Data... Save Areas... Load Areas...



BT-35 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building C, South

Location: Hallway Ceiling @ Lights & Smoke Alarm



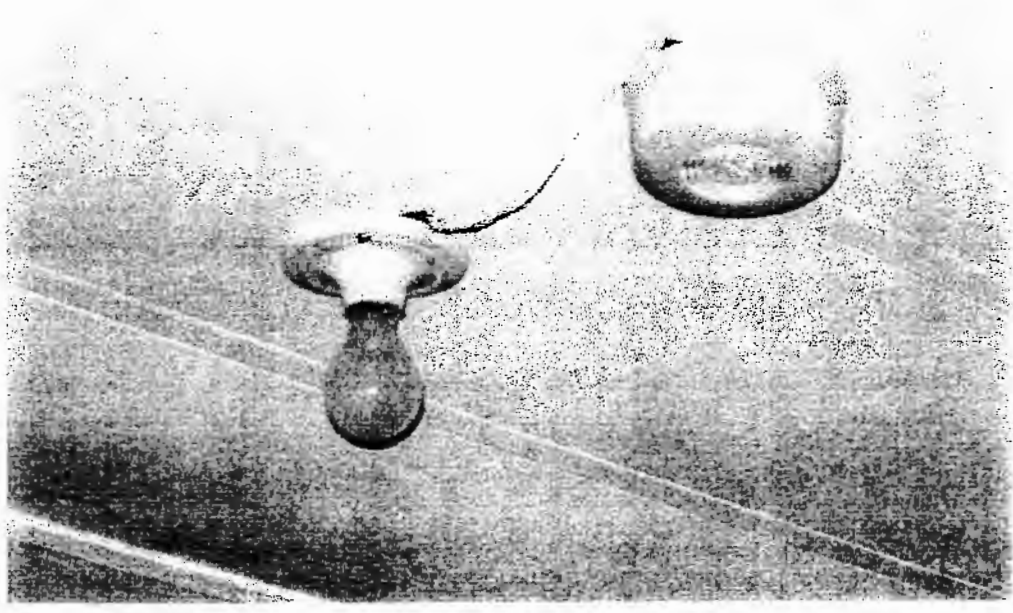
Ceiling light fixtures and smoke alarms were found to be upper envelope leak areas. These are not so cold as other areas indicating infiltrating air is being warmed as it passes through the roof framing and insulation. These are still leaks to outside and need to be sealed.

Area_Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
C1	23.90	19.93	25.88	0.95	9.0e-001	1.00
R1	23.05	17.68	24.72	0.92	8.5e-001	1.00

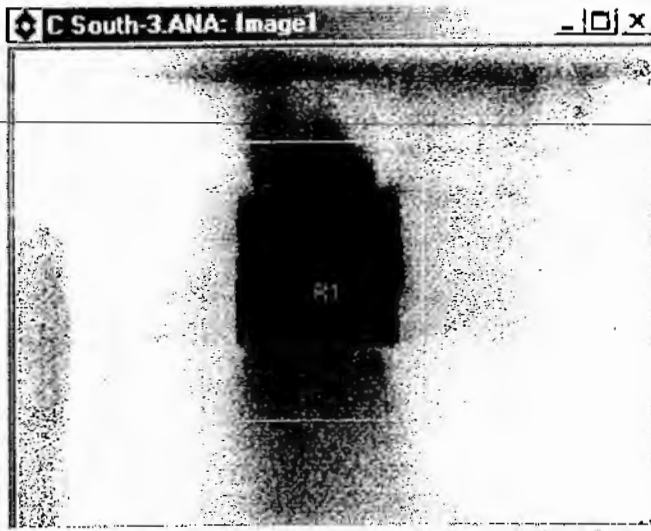
Save Data...

Save Areas...

Load Areas...



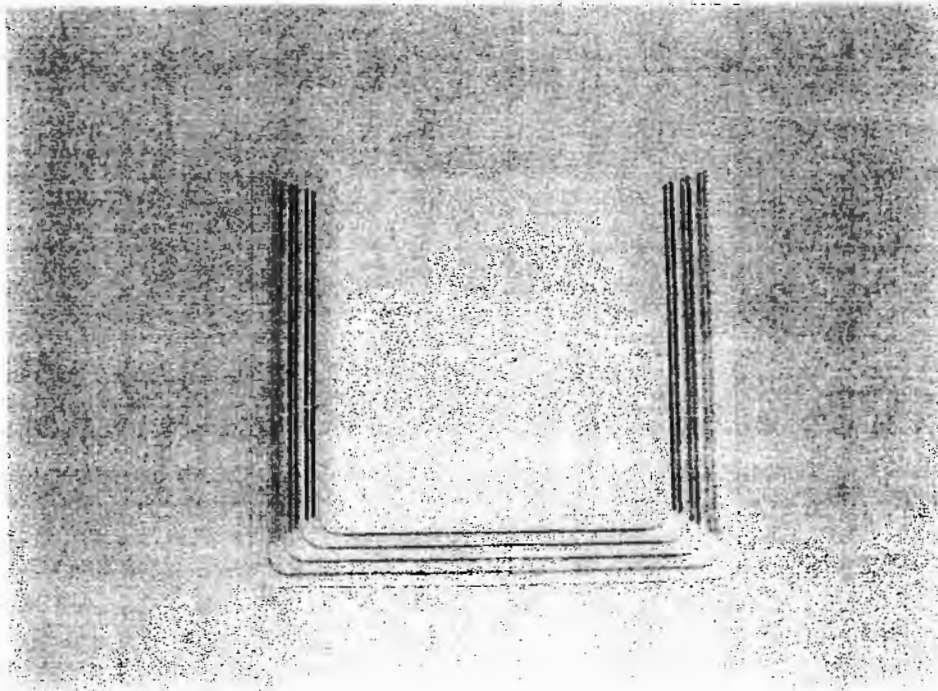
BT-36 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building C, South
Location: Bathroom @ Exhaust Fan Through Wall



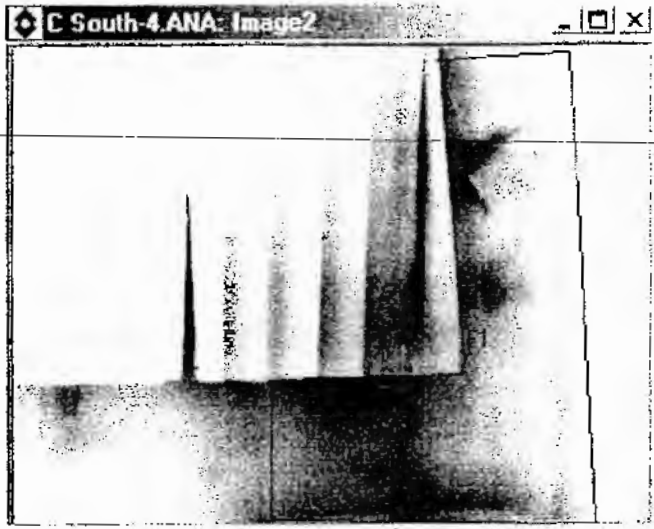
Here is another view of a bathroom fan that may as well be on all the time. Cold air is easily rushing in past any damper and cooling the fan cover. As it is installed on the wall this design is less critical than those penetrating the ceiling / roof assembly.

Area_Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
R1	22.06	14.36	25.24	2.45	6.0e+000	1.00

Save Data... Save Areas... Load Areas...



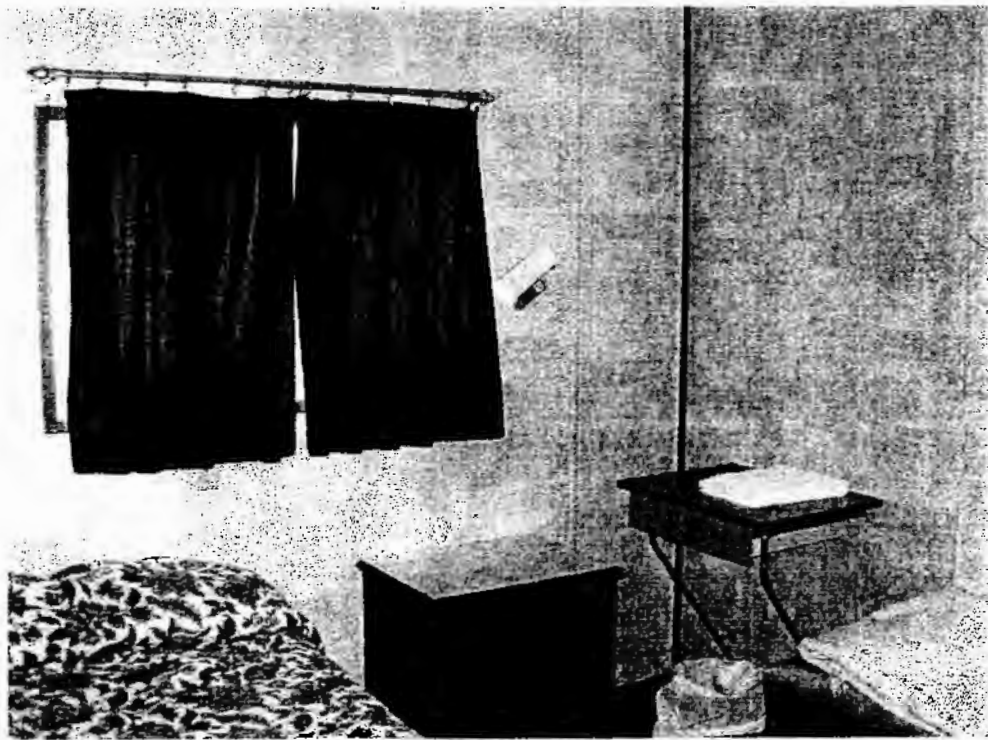
BT-37 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building C, South
Location: Bedroom @ Window Installation



Some of this is due to poorly installed insulation and some from air leaks. Again, application of a comprehensive exterior retrofit will minimize such deficiencies and allow for reductions in fuel use and maintenance expenses.

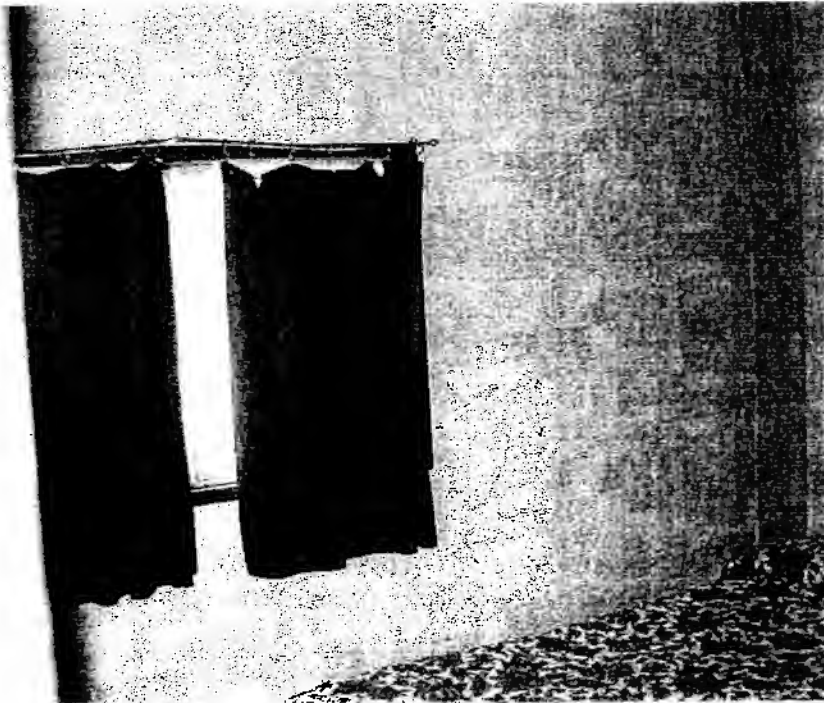
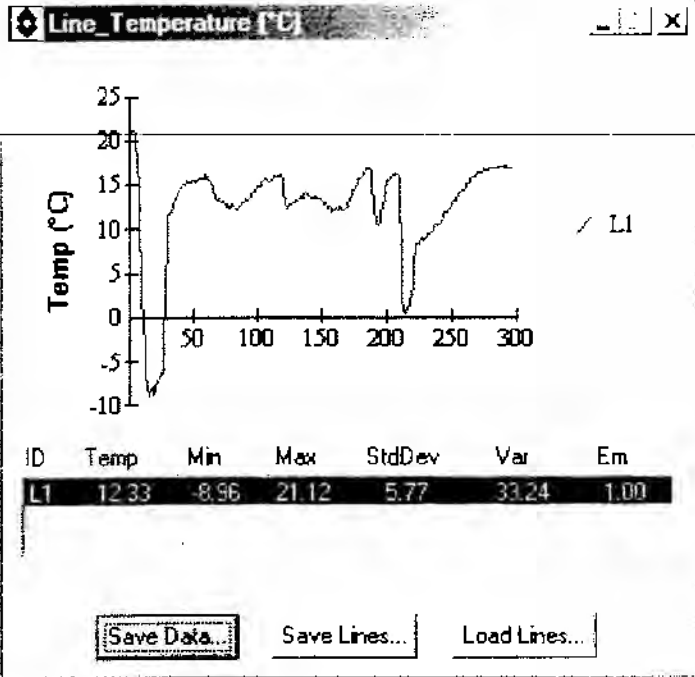
ID	MeanT	Min	Max	StdDev	Var	Em
F1	14.05	7.13	17.82	1.54	2.4e+000	1.00

Buttons: Save Data... Save Areas... Load Areas...



BT-38 - October 15, 2001
101 Mile Motor Inn-Beaver Creek, YT - Building C, South
Location: Bedroom @ Window Installation

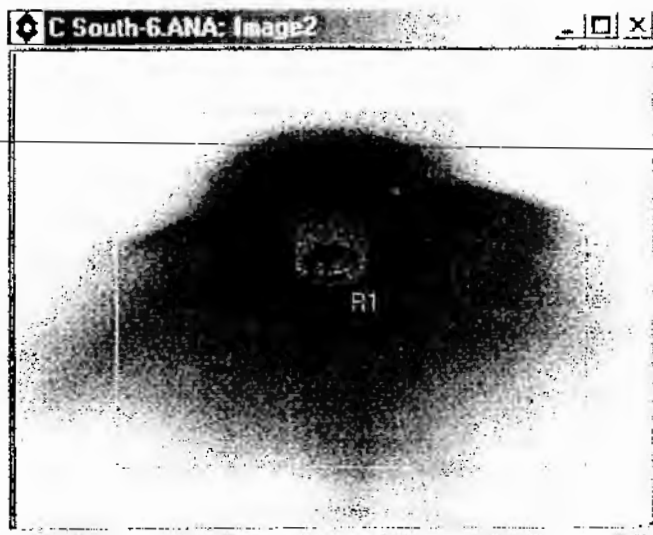
One can almost hear the wind blowing just by looking at the thermogram below. Window frame to rough opening gaps are leaking air.



BT-39 - October 15, 2001

101 Mile Motor Inn-Beaver Creek, YT - Building C, South

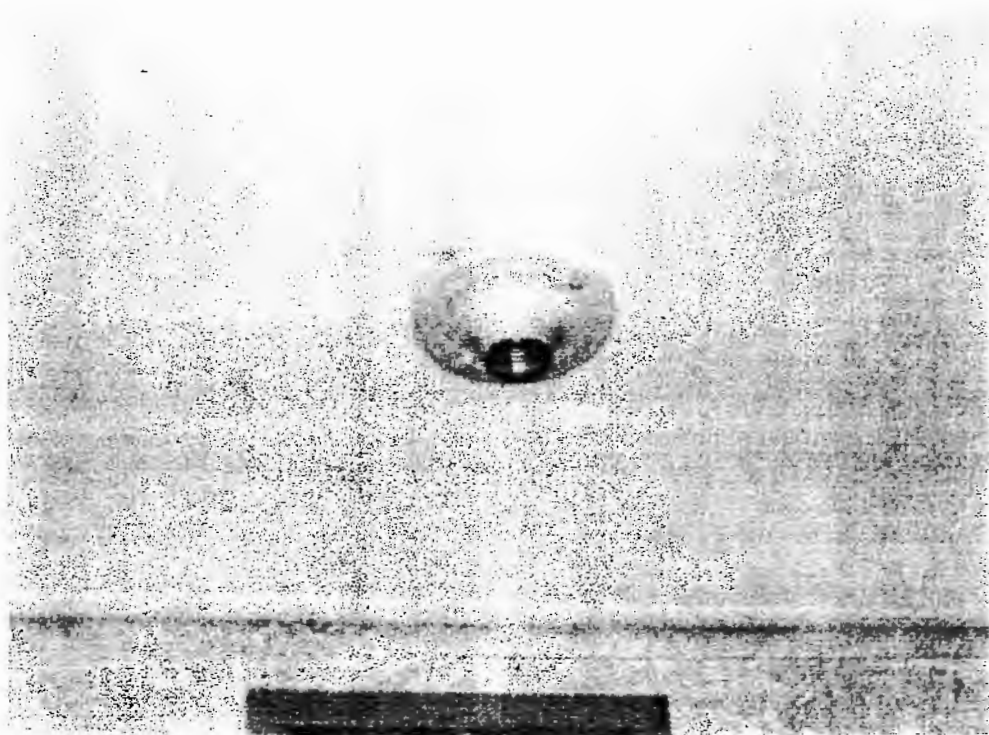
Location: Bedroom Ceiling @ Light Fixture



Ceiling penetrations are the worst culprit for their contribution to building degradation. Air from inside containing moisture will condense as it leaks past the cold surface, wetting insulation and robbing it's effectiveness. Sealing from the top down is the answer.

Area_Temperature [°C]						
ID	MeanT	Min	Max	StdDev	Var	Em
R1	21.32	14.92	24.37	1.76	3.1e+000	1.00

Save Data... Save Areas... Load Areas...



APPENDIX D

1202 MOTOR INN - AKWARM ANALYSIS:

AKWARM SUMMARY

COST BY COMPONENT GRAPH

UNIT B - AS IS (50.9 POINTS)

UNIT B - POST IMPROVEMENT (88.0 POINTS)

**SUMMARY OF AKWARM ANALYSIS ON UNIT B
COMPARISON OF FEATURES FOR BEFORE AND AFTER RETROFIT
MILE 1202 MOTOR INN, BEAVER CREEK, CANADA**

COMPONENT	BEFORE	AFTER
Floor insulation	R-9.6	R-14
Wall/Door	R-9.2	R-21
Ceiling	R-21	R-52
Window	R-1.5	R-4.0
Air Leakage	5.0 ACH/50	2.0 ACH/50
Space Heating	57% Efficiency	74% Efficiency
H2O Heating	50% Efficiency	85% Efficiency
Ventilation	None	HRV
Estimated Energy Use		
Space Heating	\$4,844US	\$1,513US
Water Heating	\$1,002US	\$590US
Lights and Appliances	\$2,478US	\$2452US
Estimated Annual Savings		\$3,809US

The above estimate was performed on Unit B to illustrate the potential for savings projected by installing those retrofit features that AKWarm indicated were cost effective. Electrical savings were not included in this analysis except for minor reductions due to the use of more efficient heating appliances.

The Owners have installed many compact florescent lights but claim the savings have not been as high as expected. It is important to understand that lighting modifications should only be performed on fixtures that are in operation for more than four hours per day. This would include public lighting, commercial area lighting and possibly some long term rental motel room lights.



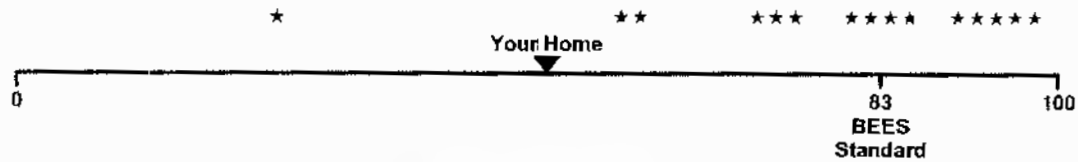
HOME ENERGY RATING CERTIFICATE

The Home Located At:
1202 Mile Alaska Hwy - YT
Northway, Alaska

Has Been Energy-Rated As:

★ ★
Two Stars

Overall Efficiency of Home
50.9 points



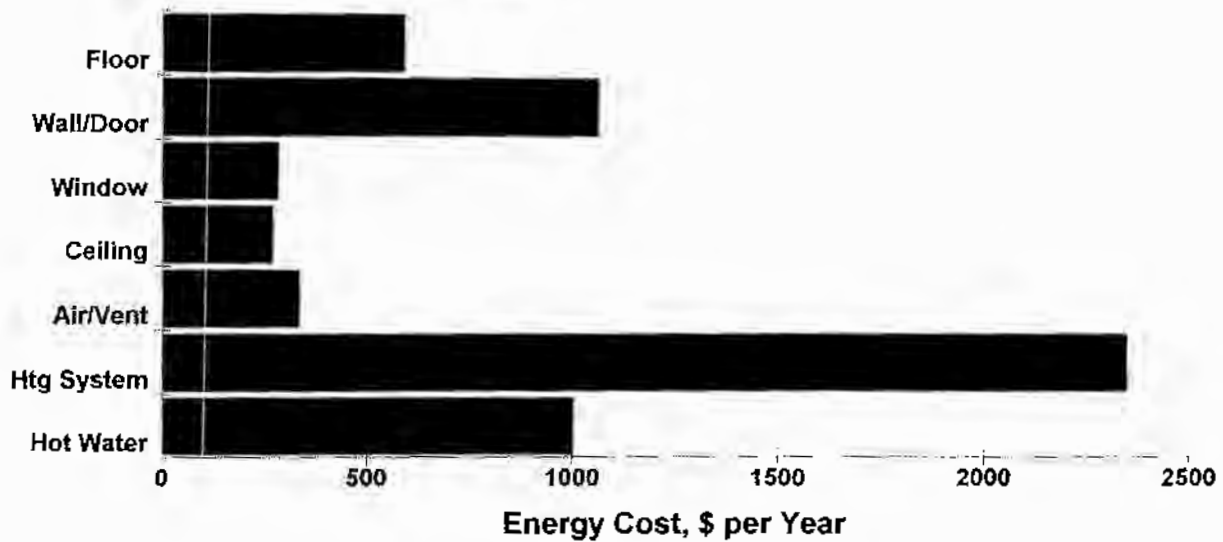
Projected Annual Energy Costs

\$8,364 per year

Amount of CO2 Produced by the Home

80,197 pounds per year

BREAKDOWN OF HEATING COSTS



Client: Robert Beatty

Rater: Phil Loudon, Arctic Technical Services

Date: 11/7/01

Rater's City: Fairbanks, Alaska 99701

Phone: 907.457.8368

FAX: 907.457.8007

ver. 1.03d. library: 7/1/1999

ENERGY COST AND FEATURES REPORT

Property: Robert Beatty
1202 Mile Alaska Hwy - YT
Northway, Alaska

Rater: Phil Loudon
Arctic Technical Services
1318 Well Street
Fairbanks, Alaska 99701

House: Living Floor Area: 1,248 square feet
No Attached Garage

Rating: As Is
ID: 1202-B

The measured air tightness of this home indicates that it may not provide sufficient ventilation air (for acceptable indoor quality) as defined by ASHRAE 62-89, without adequate mechanical ventilation equipment. If whole house mechanical ventilation equipment has been installed, it is recommended that it be properly maintained and operated. If no whole house mechanical ventilation equipment has been installed, it is strongly recommended that the homeowner consider an investment in this improvement. (A test of the building's ventilation air rate would help determine the importance of a mechanical ventilation system in this home.)

ENERGY FEATURES

Envelope Efficiency

Floor Insulation	R-9.6 *
Wall/Door Insulation	R-9.2
Ceiling Insulation	R-21
Window R-Value	R-1.50
Window to Wall Ratio, Living Space	5.9%
South Facing Window Area	13 square feet
Air Leakage	5.0 Air Changes per Hour at 50 Pascals 0.26 Air Changes per Hour Natural

* Includes the insulating value of the ground in contact with these envelope components.

Space Heating System

System Efficiency	57%
Fuel Type	Propane
Supplemental Fuel	None
Thermostat Setting	70.0 degrees F
Setback Thermostat	None

Water Heater

Efficiency	50%
Location	Semi-Conditioned Space
Fuel Type	Propane

Ventilation

System Type	None
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Other

Number of Occupants	6
Clothes Dryer Fuel	None
Cooking Range Fuel	None
Miscellaneous Lights/Appliances Use	Average

ESTIMATED ENERGY USE

Space Heating	[REDACTED]	\$4,884
Water Heating	[REDACTED]	\$1,002
Lights and Appliances	[REDACTED]	\$2,478

Space Heating	2,355 kWh of Electricity, 3,171 gallons of Propane
Water Heating	716 gallons of Propane
Lights and Appliances	13,124 kWh of Electricity

Actual use and costs may vary from these estimates depending upon weather conditions, occupant life styles and utility rates currently in effect.

ver. 1.03d, library: 7/1/1999

ent: Robert Beatty
 e at: 1202 Mile Alaska Hwy - YT
 rthway, AK 99615

Energy Flows below are in Btu/hour

Month	Hours	Gross Loss	Gross Internal	Net Internal	Gross Solar	Net Solar
744	52041	7860	7860	118	116	
678	46499	7593	7593	890	886	
744	38732	7229	7229	2311	2303	
720	25710	6865	6865	3373	3277	
744	15255	6598	6598	3244	2965	
720	9067	6501	6065	3492	2303	
744	7857	6598	5780	3091	1777	
744	10583	6865	6598	2380	1999	
720	17128	7229	7229	1811	1757	
744	28762	7593	7593	1047	1043	
720	41520	7860	7860	354	349	
744	50326	7957	7957	6	6	

ANNUAL ENERGY FLOWS

Gross Loss: 250.2 MMBtu

Gross Internal: 63.4 MMBtu
 Available Internal: 62.2 MMBtu
 Internal Utiliz.: 0.982

Gross Solar: 16.2 MMBtu
 Available Solar: 13.7 MMBtu
 Solar Utiliz.: 0.849

Net Heat Load: 174.3 MMBtu

DECEMBER UA VALUES AND DESIGN HEAT LOSS

Living Space UA: 597.0 Btu/hr/deg F
 Garage UA: 0.0 Btu/hr/deg F
 Design Heat Loss (70 deg Indoor, 70 deg Garage): 73,429 Btu/hr

ENERGY EFFICIENCY IMPROVEMENT OPTIONS

Property: Robert Beatty
1202 Mile Alaska Hwy - YT
Northway, Alaska

Rater: Phil Loudon
Arctic Technical Services
1318 Well Street
Fairbanks, Alaska 99701

House:
Living Floor Area: 1,248 square feet
No Attached Garage

Rating: As Is
ID: 1202-B

COST-EFFECTIVE IMPROVEMENTS:

Improvement Description	Location	Savings to Cost Ratio	Installed Cost	Annual Savings	Break-Even Cost	Rating Points Gained	Note
Install 4' of R-10 rigid board insulation on Perimeter of Crawl Space Floor.	On- or Below-Grade Floor, Perimeter: House	11.16	\$982	\$752	\$10,956	6.9	
Replace Heating Plant with New Furnace (60,000-100,000Btu) having AFUE of 93%.	Primary Heating System	6.97	\$2,722	\$1,342	\$18,962	12.0	
Replace Gas tank with efficient "side-arm" to 80,000 Btu boiler		3.72	\$818	\$172	\$3,047	3.0	
Install R-14 rigid foam board to interior of wall.	Above-Grade Wall: House-Skirting	3.68	\$979	\$244	\$3,598	2.2	
Install R-30 fiberglass batts in attic.	Ceiling w/ Attic: House	2.56	\$1,607	\$279	\$4,116	2.5	
Remove existing door and install standard pre-hung R-7 metal insulated door, including hardware.	Exterior Door: House-Mech Rooms	2.52	\$817	\$139	\$2,058	1.2	
Remove existing glass and install triple lowE arg glass.	Window/Skylight: House-Vinyl	2.14	\$727	\$105	\$1,556	1.0	
Install R-14 rigid foam board to exterior and cover with T1-11 siding or equivalent.	Above-Grade Wall: House	1.83	\$5,155	\$639	\$9,435	5.7	
Total, Cost-Effective Measures		3.89	\$13,806	\$3,672	\$53,729	34.5	

New Rating After Measures: Four Stars Plus, 85.4 points
Annual CO2 Reduction: 32,707 pounds per year

The following improvements were not found to be cost-effective based on energy savings:

Improvement Description	Location	Savings to Cost Ratio	Installed Cost	Annual Savings	Break-Even Cost	Rating Points Gained	Note
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Improvement Description	Location	Savings to Cost Ratio	Installed Cost	Annual Savings	Break-Even Cost	Rating Points Gained	Note
Replace existing window with R-2.5 vinyl window	Window/Skylight: House-South	0.80	\$515	\$28	\$412	0.2	
Replace existing window with R-2.5 vinyl window	Window/Skylight: House	0.80	\$2,574	\$139	\$2,051	1.2	
Caulk and Seal so that Home Air Leakage is Reduced by 500 CFM at 50 Pascals.		0.57	\$800	\$55	\$458	0.5	
Total, All Measures		3.20	\$17,695	\$3,893	\$56,650	36.4	

New Rating After Measures: Four Stars Plus, 87.3 points
 Annual CO2 Reduction: 34,649 pounds per year

ver. 1.03d, library: 7/1/1999



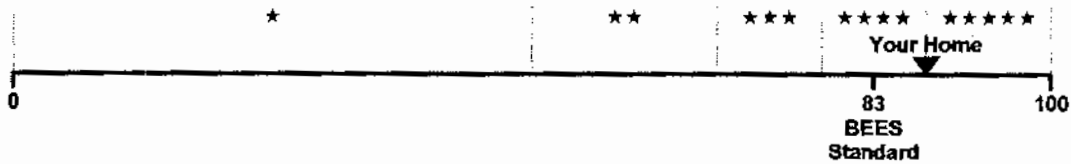
HOME ENERGY RATING CERTIFICATE

The Home Located At:
1202 Mile Alaska Hwy - YT
Northway, Alaska

Has Been Energy-Rated As:

★ ★ ★ ★ ★
Five Stars

Overall Efficiency of Home
88.0 points



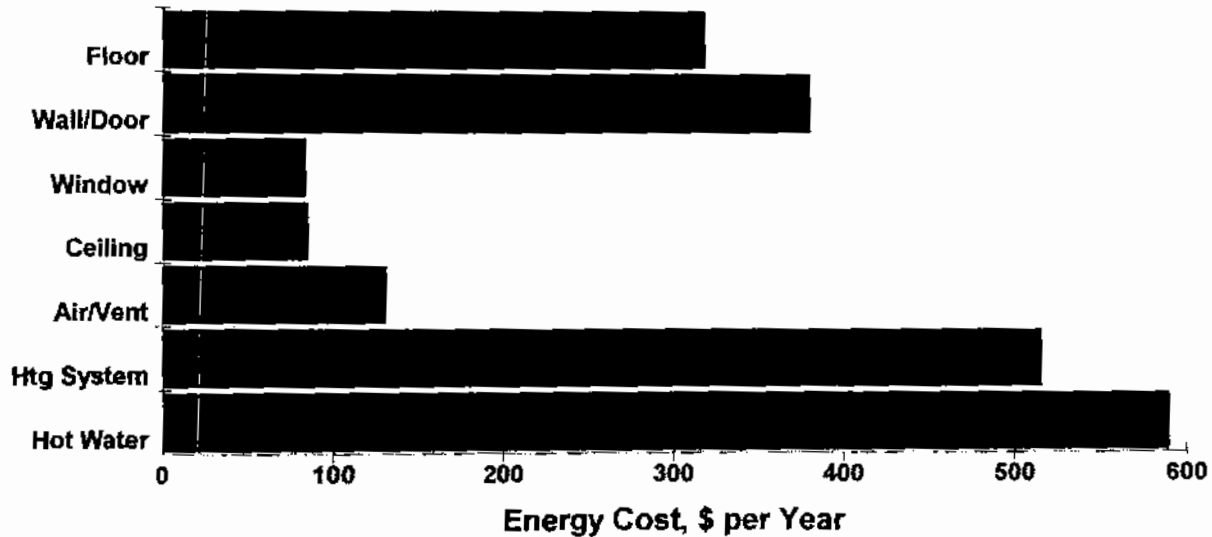
Projected Annual Energy Costs

\$4,555 per year

Amount of CO2 Produced by the Home

46,206 pounds per year

BREAKDOWN OF HEATING COSTS



Client: Robert Beatty- POST Rater: Phil Loudon, Arctic Technical Services

Date: 11/7/01

Rater's City: ~b Fairbanks, Alaska 99701

Phone: 907.457.8368

FAX: 907.457.8007

ver. 1.03d, library: 7/1/1999

ENERGY COST AND FEATURES REPORT

Property: Robert Beatty- POST
1202 Mile Alaska Hwy - YT
Northway, Alaska

Rater: Phil Loudon
Arctic Technical Services
1318 Well Street
Fairbanks, Alaska 99701

House: Living Floor Area: 1,248 square feet
No Attached Garage

Rating: Post Improvement
ID: 1202-B2 post

The measured air tightness of this home indicates that it may not provide sufficient ventilation air (for acceptable indoor quality) as defined by ASHRAE 62-89, without adequate mechanical ventilation equipment. If whole house mechanical ventilation equipment has been installed, it is recommended that it be properly maintained and operated. If no whole house mechanical ventilation equipment has been installed, it is strongly recommended that the homeowner consider an investment in this improvement. (A test of the building's ventilation air rate would help determine the importance of a mechanical ventilation system in this home.)

ENERGY FEATURES

Envelope Efficiency

Floor Insulation	R-14.0 *
Wall/Door Insulation	R-21
Ceiling Insulation	R-52
Window R-Value	R-4.0
Window to Wall Ratio, Living Space	5.9%
South Facing Window Area	13 square feet
Air Leakage	2.0 Air Changes per Hour at 50 Pascals 0.11 Air Changes per Hour Natural

* Includes the insulating value of the ground in contact with these envelope components.

Space Heating System

System Efficiency	74%
Fuel Type	Propane
Supplemental Fuel	None
Thermostat Setting	70.0 degrees F
Setback Thermostat	None

Water Heater

Efficiency	85%
Location	Semi-Conditioned Space
Fuel Type	Propane


Ventilation

System Type	Heat Recovery Ventilator
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Other

Number of Occupants	6
Clothes Dryer Fuel	None
Cooking Range Fuel	None
Miscellaneous Lights/Appliances Use	Average

ESTIMATED ENERGY USE

Space Heating		\$1,513
Water Heating		\$590
Lights and Appliances		\$2,452

Space Heating	927 kWh of Electricity, 960 gallons of Propane
Water Heating	421 gallons of Propane
Lights and Appliances	13,428 kWh of Electricity

Actual use and costs may vary from these estimates depending upon weather conditions, occupant life styles and utility rates currently in effect.

ver. 1.03d, library: 7/1/1999

Home at: 1202 Mile Alaska Hwy - YT
Northway, AK 99615

Energy Flows below are in Btu/hour

Month	Hours	Gross Loss	Gross Internal	Net Internal	Gross Solar	Net Solar
1	744	26059	6857	6857	72	71
2	678	23345	6590	6590	545	540
3	744	19520	6226	6226	1425	1419
4	720	12939	5862	5862	2096	1967
5	744	7606	5595	5174	2022	1540
6	720	4478	5498	3858	2185	620
7	744	3868	5595	3481	1931	387
8	744	5228	5862	4372	1479	843
9	720	8537	6226	5775	1114	1072
10	744	14496	6590	6590	645	642
11	720	20908	6857	6857	215	212
12	744	25222	6954	6954	4	4

ANNUAL ENERGY FLOWS

Gross Loss: 125.5 MMBtu

Gross Internal: 54.6 MMBtu

Useable Internal: 50.1 MMBtu

Internal Utiliz.: 0.918

Gross Solar: 10.0 MMBtu

Useable Solar: 6.8 MMBtu

Solar Utiliz.: 0.677

Net Heat Load: 68.6 MMBtu

DECEMBER UA VALUES AND DESIGN HEAT LOSS

Living Space UA: 299.2 Btu/hr/deg F

Garage UA: 0.0 Btu/hr/deg F

Design Heat Loss (70 deg Indoor, 70 deg Garage): 36,801 Btu/hr

ENERGY EFFICIENCY IMPROVEMENT OPTIONS

Property: Robert Beatty- POST
1202 Mile Alaska Hwy - YT
Northway, Alaska

Rater: Phil Loudon
Arctic Technical Services
1318 Well Street
Fairbanks, Alaska 99701

House:
Living Floor Area: 1,248 square feet
No Attached Garage

Rating: Post Improvement
ID: 1202-B2 post

COST-EFFECTIVE IMPROVEMENTS:

Improvement Description	Location	Savings to Cost Ratio	Installed Cost	Annual Savings	Break-Even Cost	Rating Points Gained	Note
Install 4' of R-5 rigid board insulation on Perimeter of Crawl Space Floor.	On- or Below-Grade Floor, Perimeter: House	13.18	\$489	\$439	\$6,449	3.9	
Install R-10 rigid foam board to interior of wall.	Above-Grade Wall: House-Skirting	1.55	\$701	\$74	\$1,085	0.7	
Total, Cost-Effective Measures		6.33	\$1,190	\$513	\$7,534	4.6	

New Rating After Measures: Five Stars Plus, 92.6 points
Annual CO2 Reduction: 4,518 pounds per year

The following improvements were not found to be cost-effective based on energy savings:

Improvement Description	Location	Savings to Cost Ratio	Installed Cost	Annual Savings	Break-Even Cost	Rating Points Gained	Note
Replace Heating Plant with New Furnace (60,000-100,000Btu) having AFUE of 93%.	Primary Heating System	0.76	\$2,722	\$147	\$2,076	1.2	
Install R-19 fiberglass batts in attic.	Ceiling w/ Attic: House	0.65	\$1,035	\$45	\$672	0.4	
Install R-5 rigid foam board to exterior and cover with T1-11 siding or equivalent.	Above-Grade Wall: House	0.42	\$2,640	\$75	\$1,112	0.6	
Remove existing door and install standard pre-hung R-7 metal insulated door, including hardware.	Exterior Door: House-Mech Rooms	0.00	\$817	\$0	-\$1	0.0	
Remove existing glass and install triple lowE arg glass.	Window/Skylight: House-Vinyl	-0.03	\$727	-\$2	-\$22	0.0	
Replace existing window with R-2.5 vinyl window	Window/Skylight: House-South	-0.21	\$515	-\$7	-\$109	-0.1	
Replace existing window with R-2.5 vinyl window	Window/Skylight: House	-0.28	\$2,574	-\$50	-\$731	-0.4	

Improvement Description	Location	Savings to Cost Ratio	Installed Cost	Annual Savings	Break-Even Cost	Rating Points Gained	Note
Replace Gas tank with efficient "side-arm" to 80,000 Btu boiler		-2.44	\$818	-\$112	-\$1,998	-1.9	
Total, All Measures		0.65	\$13,037	\$611	\$8,534	4.4	

New Rating After Measures: Five Stars Plus, 92.4 points
 Annual CO2 Reduction: 5,373 pounds per year

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UV GUARD™ PREMIUM CAULKING WAS DEVELOPED BY WEATHERALL CO., INC., A LEADING MANUFACTURER OF QUALITY PRODUCTS FOR THE LOG HOME AND CONSTRUCTION INDUSTRY.



Weatherall Northwest
658 Highway 93 South
Hamilton, MT 59840
1-800-531-2286

UV GUARD™ PREMIUM CAULKING

The premium
professional
strength
adhesive
sealant.

When you have a job that calls for strong, long-lasting caulking, the best choice is professional strength UV GUARD™ PREMIUM CAULKING. Specially formulated for a wide variety of construction-related applications, UV GUARD™ PREMIUM CAULKING cures quickly and forms a powerful adhesive bond that will remain amazingly flexible, water-resistant and weathertight for many years to come.

THE
PREMIUM
CHOICE

FOR
QUALITY,
APPEARANCE
AND
LONGEVITY

- Stronger adhesion
- Superior durability
- Excellent elongation
- Greater flexibility
- Resists water
- Resists mildew
- Resists harmful UV rays
- Environmentally safe
- Easy to apply
- Cures quickly
- Easy to clean up with water
- Exceeds ASTM Spec. C-834-76

THE
PREMIUM
CHOICE

FOR
A
MULTITUDE
OF
APPLICATIONS

- Log home construction
- Coated and uncoated wood
- Sheet metal
- Painted surfaces
- Masonry
- Stucco
- Drywall
- Window and door frames
- Baseboards and moldings
- Siding and trim
- Corner joints
- Pipes and vents

MANUFACTURERS RECOMMENDED SPECIFICATIONS

Weatherall 1010 Chinking®



Weatherall Company, Inc.

1. PRODUCT NAME

Weatherall 1010 Chinking®

2. MANUFACTURER

Weatherall Company, Inc.

Corporate Headquarters

Denver, CO

1-800-399-8609

FAX: (303) 740-6019

Manufacturing Plant

106 Industrial Way

Charlestown, IN 47111

1-800-367-7068

FAX: (812) 256-2344

3. PRODUCT DESCRIPTION

Weatherall 1010 Chinking® is a flexible, mortar-textured sealant specifically designed for use in log homes. Formulated from a thoroughly tested blend of latex acrylics chosen for superior weathering, adhesive and flexing characteristics, Weatherall 1010 Chinking® replaces mortar-based chinking, mastics and glossy caulks. Available colors: Standard Grey, Southern Grey, Light Grey, Standard Tan, Western Tan, Woodtone, Stone.

4. BASIC USE

Weatherall 1010 Chinking® is used in log joints where a positive, weather-tight seal is needed and a neat, mortar-textured finish is desired. Weatherall 1010 Chinking® is available in a wide range of colors to either imi-

tate the traditional look of mortar chinking or to blend in with the tones of the wood.

Weatherall 1010 Chinking® makes an excellent restorative coating over previously applied mortar chinking, mastics or caulks. Weatherall 1010 Chinking® is also the easiest chinking to apply for the do-it-yourself applicator.

5. ADVANTAGES

• Stays Flexible

Weatherall 1010 Chinking® provides a resilient mortar-textured finish that stays flexible and expands or contracts with the log movement.

• Seals Out Air and Moisture

Weatherall 1010 Chinking® provides a simple, effective seal that eliminates air and water infiltration and significantly improves energy efficiency.

• Durable

Weatherall 1010 Chinking® forms a tough, damage-resistant surface that withstands wind-driven rain, salt spray and most chemicals. It has excellent weathering properties in temperature extremes and excellent color retention.

• Attractive

Weatherall 1010 Chinking® adds a beautiful, finished appearance to log walls. It does not have the messy synthetic appearance of some other sealant materials.

• Quick Drying

Weatherall 1010 Chinking® cures more

quickly than other brands of synthetic chinking; consequently, it does not remain tacky and is not prone to attracting job-site dust and other air borne contaminants.

• Fungus Resistant

Weatherall 1010 Chinking® contains a tested proven fungicide.

• Non-Toxic

Weatherall 1010 Chinking® is safe for both interior and exterior use and has no odor when cured.

• Fully Warranted

Weatherall 1010 Chinking® comes with a full 5 year warranty

6. TECHNICAL INFORMATION

Texture

Semi-matte sand texture. Can be tooled to achieve a semi-smooth to rough finish.

Recommended Thickness

Finish troweled thickness should be from $\frac{3}{16}$ to $\frac{1}{4}$ in. across the face of the Tri-Rod®.

Drying Time

Weatherall 1010 Chinking® will be skinned over on surface in 20-30 min. and will be surface dry in 8-10 hours under normal conditions. It will be fully cured in 7-10 days. Actual times will vary depending on temperature and relative humidity. It should be protected

PHYSICAL PROPERTIES		TEST DATA		
		SPECIFICATION	TEST	RESULT
Viscosity:	250000 cps +10000	1. ASTM C-834-76	Latex Sealing Compounds	Passed
Density:	14 lbs/gal +/- 1	2. ASTM G-53	QUV Accelerated Weathering	3000 Hours
pH:	9+	3. ASTM D-638	Elongation	50% plus
Stability:	One year shelf life when stored in a tightly sealed container at moderate temperatures.	4. ASTM D-638	Tensile Strength	145 psi
		5. LABC Div. 61	Toxicity	Passed
		6. BPA Energy Program	Blower Door Test	Passed
		7. Compressive Shear	Adhesion (pine, birch, oak)	82-125 psi
		8. ASTM E-84	Flame Spread	Passed
		9. MIL-S-8802	Slump	Passed

from contact damage for 2-3 days after application.

Coverage

The following guide is offered to assist in estimating coverage and quantities required. Measure the total number of lineal feet of log joint, exterior and interior, and estimate the average width of the finished chink joint. Remember to include corners, door and window bucks, gable lines, purlin and joist notches, etc., in addition to the horizontal chink lines.

Clean Up

Immediate soap and water clean up.

Packaging

Weatherall 1010 Chinking® is sold in 5 gallon pails, 11oz. and 30 oz. plastic cartridges.

Storage

Must be protected from freezing and stored in temperatures that do not

exceed 90° F. Opened containers may be stored by floating a thin film of water (1/16 in.) on the surface of the material, covering it with plastic, and tightly relidding the container.

7. APPLICATION

Surface Prep

The logs must be clean, structurally sound, dry (19% moisture maximum) and free from any grease, paraffins, oils or other contaminants that could inhibit the ability of the chinking to penetrate and bond to the wood fibers.

Note: Some wood finishes will leave a film on the wood surface that can adversely affect the adhesion of the chinking. Finishes that contain oils, petroleum distillates, paraffins or any other finish that is film forming or very freshly applied may not allow the chinking to properly bond. Applying any wood finish, other than Weatherall

Clear UV GUARD® Wood Finish or Log Guard, on top of the chinking will leave a discoloration on the chinking. Weatherall's Clear UV GUARD® Wood Finish makes an excellent maintenance coating and will not discolor the chinking.

If you have a previously applied wood finish, or are in doubt as to the compatibility of your finish with the chinking, contact Weatherall Technical Support.

Application Temperature

Weatherall 1010 Chinking® should not be applied when temperatures are below 40° F, or when subfreezing temperatures are expected within 48 hours of application. Avoid chinking in the rain or when rain is imminent.

Note: There may be occasions when chinking in subfreezing or rainy weather is unavoidable. In such cases, contact your Weatherall representative for specific recommendations.

ESTIMATING GUIDE FOR CHINKING

FINISHED JOINT WIDTH	Per 5 Gal Pail	Per 30oz Tube	Per 11oz Tube	Backing Used
1"	325'	15'	6'	3/4" Tri-Rod®
1 1/4"	250'	13'	5'	1" Tri-Rod®
1 3/4"	225'	12'	4 1/2'	1 1/4" Tri-Rod®
2"	175'	8'	3'	1 1/2" Tri-Rod®
2 1/2"	125'	5'	2'	2" Tri-Rod®

Note: Thickness of joint should be 3/16" - 1/4". DO NOT EXCEED THICKNESS OF 1/4".

YOUR DISTRIBUTOR

Weatherall Northwest
658 Highway 93 South
Hamilton, MT 59840
1-800-531-2286

DISTRIBUTION: Weatherall products are available from a national network of distributors.

CORPORATE OFFICE: 6820 So. Jasmine Ct. Englewood, CO 80112
TEL: (800) 399-8609 • FAX: (303) 740-6019

MANUFACTURING: 106 Industrial Way, Charlestown, IN 47111
TEL: (800) 367-7068 • FAX: (812) 256-2344

TECHNICAL SUPPORT Morrison, CO
(800) 399-1680/FAX: (303) 697-1601

When chinking in very hot weather, it is recommended that the chinking be applied to the shaded side of the house.

Backer Rod System

When applying Weatherall 1010 Chinking® to new construction or to previously unchinked structures, it must be applied over a triangular shaped, closed-cell, non-adhesive backing such as Weatherall Tri-Rod®. This type of backer-rod system provides several critical advantages:

- 1) It creates the ideal slip joint design which allows only two points of adhesion: to the wood surface at the top and bottom of the joint.
- 2) The rounded edges create a wider footprint at the top and bottom where the chinking is in contact with the wood.
- 3) It provides a flat, even surface over which to tool the chinking.
- 4) It is water resistant and highly insulating.

Note: In joints less than 3/4 inch wide, closed cell, round polyethylene rod may be used. In this case, it is important that a minimum chinking thickness of 1/4 inch be maintained over the entire surface of the joint. The effect will necessarily be a convex shape over the round rod. Do not cut the round rod in half and place the cut side out to simulate Tri-Rod®. The cut face will not release the chinking and it may fail at the edges.

Chinking Application

Weatherall 1010 Chinking® can be applied with a bulk loading caulking gun, grout bag or commercial chink pump. The applied bead should be firmly trowled into the edges to insure complete edge adhesion. Use of a 50/50 mixture of isopropyl alcohol and water as a release agent will

allow the trowel to glide smoothly over the chinking.

Note: UV GUARD® Wood Finish or Log Guard should be applied prior to chinking for two reasons: 1) UV GUARD® Wood Finish acts as a primer and creates a better bonding surface to chink to. 2) Pigmented stains subsequently applied will discolor chinking. Maintenance coats of Clear UV GUARD® Wood Finish or Log Guard will not discolor chinking.

Application Guide

Weatherall Co. Inc. has prepared a detailed Chinking Application Guide for use in application of its products. This guide is free from your Weatherall representative and provides more detailed instructions and helpful hints to the applicator.

8. AVAILABILITY & COST

Weatherall 1010 Chinking® and related products are available from the Weatherall Manufacturing Plant in Charlestown, IN, and regional distributors.

9. WEATHERALL LIMITED WARRANTY

Weatherall 1010 Chinking® is warranted for a period of five (5) years from the date of manufacture when installed in accordance with the application instructions provided by Weatherall Company, Inc.

Exceptions: This warranty does not cover failures due to the following:

- Fire, flood, natural disaster or any acts of God.
- Improper storage, handling or installation.
- Plumbing leaks, faulty construction or house settling that would exceed the materials elasticity.

The Weatherall Commitment

If Weatherall 1010 Chinking® is proved to have failed during the warranty period, Weatherall Company, Inc. will replace the failed material FOB its nearest distribution point.

Weatherall Company, Inc. reserves the right to inspect the job site by an authorized representative prior to the settlement of any claims.

Notification of claims must be made in writing to Weatherall Company, Inc. upon discovery.

Weatherall's sole and complete responsibility for proved material failure is as set forth in this warranty. Weatherall Company, Inc. will not be responsible for incidental, indirect or consequential damages including re-installation labor.

Questions concerning this warranty should be directed to the nearest Weatherall representative.

10. TECHNICAL SERVICE

For technical service, on-site consultation and other information, contact the Weatherall Corporate Headquarters.

Low Flow Showerhead

The hot water that many of us take for granted can account for a substantial portion of your total energy costs—as much as 25%, depending on use. In many cases, showers can be the largest single contributor to overall hot water use. Even a modest 10-minute shower can use up to 60 gallons of hot water with a conventional showerhead. A low-flow showerhead can reduce this by as much as half, without sacrificing the "feel" of the shower. There are a wide variety of low-flow showerheads available, including hand-held and designer models.

How It Works

By restricting the flow and forcing the water through very small apertures, these showerheads aerate and increase the velocity of the water, creating a very fine but "wet" feeling spray pattern. While a conventional showerhead uses 6 gallons or more per minute, the low-flow types use approximately three gallons per minute, depending on the model. Many are equipped with a push-button shutoff valve which allows the user to interrupt the flow of water while soaping up, saving even more.

Replacing a conventional showerhead with a low-flow model is usually a very quick and simple job. With a variety of adapters readily available, they can be fitted to most standard shower arms, including the swivel-type.

Example of Savings

In a 10-unit apartment building, with an average of 3 occupants per apartment, there would be as many as 30 showers per day or almost 11,000 showers per year! With conventional showerhead using 6 gallons of hot water per minute, and assuming 10 minutes per shower, the annual hot water usage would be 660,000 gallons. A low-flow showerhead would use only 330,000 gallons, saving 330,000 gallons annually. If this water is electrically heated, the annual cost savings would be \$2,989*. If the water is heated by natural gas the cost savings would be approximately \$1,443**. There would also be significant reductions in your water bill.

Payback

Based on the typical costs listed below, the payback for installing low-flow showerheads is almost immediate, depending on the frequency of showers.

Typical Cost

Standard Type -- \$8-\$12

With shutoff valve -- \$10-\$15

Designer and hand-held massage type -- \$15-\$20+

*Assuming a typical electric water heater, with an 60°F rise and a fuel cost of \$0.6/kWh

**Assuming a typical gas water heater, with an 60°F rise and a fuel cost of \$0.7/therm.

Christmas in April

Energy Efficiency Guidebook

Measure Comparison



[Previous Page](#) [Index](#) [EE Measures >>](#)

Click on any measure name for more detailed information.

Measure	Skill Level	Time to Implement	Investment	Measure Lifetime	Lifetime Savings
Toilet Flow Reducer	Low	5 min per toilet	\$0 - \$6	10+ years	\$35
Faucet Aerator	Low	20 min	\$0 - \$7	10+ years	\$75 gas water heater, \$480 electric
Low Flow Showerhead	Low	20 min	\$10 - \$20	10+ years	\$90 gas water heater, \$320 electric
Refrigerator Coil Cleaning	Low	10 min	\$0	6 months	\$5 - \$35
Water Heater Temperature Reduction	Low	10 min	\$0	10+ years	\$100 gas water heater, \$480 electric
Caulking, Weatherstripping & Door Sweeps	Low	3 hours	\$18 seals 3 windows, 1 door & gaps	4 years	\$92 gas heat, \$600 electric
Compact Fluorescent Lamps	Low	5 min per bulb	\$15 per lamp	3.4 years	\$67
Photocontrol Outdoor Light Fixtures	Medium	2 hours	\$8 - \$40	10+ years	\$290
Water Pipe Insulation	Medium	5 min per foot of pipe	\$2 - \$30	10+ years	\$70-\$210 gas, \$400-\$1200 electric heat
Water Heater Blanket	Medium	40 min	\$10 - \$17	10+ years	\$125 gas water heater, \$660 electric
Washable Electrostatic Furnace Filter	Medium	20 min	\$25	Clean for 3 months, lasts 10 years	\$130 - \$330
Heating & Cooling Duct Sealing	Medium	5 min per foot of duct	\$220	10+ years	\$450
Thermal Traps on Water Heater	High	1 hour	\$5	10+ years	\$70 gas water heater, \$400