RED DEER RENOVATION DEMONSTRATION PROJECT

Final Report on Monitoring
March, 1996

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DISCLAIMER

NOTE

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Table of Contents

Executive Summary

In 1994, the Red Deer Homebuilder's Association undertook *Red Deer Project '94*, a 'pilot' renovation demonstration sponsored by Canada Mortgage and Housing Corporation (CMHC), Natural Resources Canada (NRCan), and the Canadian Home Builders' Association (CHBA). The renovation project was carried out on a two storey, single family dwelling, which was built in 1904. The renovation was completed in September 1994. During construction and after the renovation was completed, the Red Deer team held open houses, tours and seminars, which were attended by over 1,500 people.

A project report published by CMHC in May 1995 outlined the renovation demonstration and presented specific recommendations for improving similar future projects. At the time it was prepared, the monitoring of the house had not been completed. The purpose of this report is to detail the monitoring and report on the energy performance of the house during the year after completion.

Monitoring was ongoing during the project and continued after completion. It included:

- inspections and environmental audits prior to construction;
- computer simulations to assist in choosing energy upgrades;
- documentation of the product selection process;
- system commissioning and testing on completion of the renovation;
- indoor air quality monitoring before and after occupancy; and
- the collection of gas, electricity and water consumption data for one year after the house was occupied.

The monitoring confirmed that the space heating load of the house had been reduced by approximately 65 percent and that excellent indoor air quality has been achieved. It also demonstrated some of the shortcomings of the project and laid the foundation for a series of recommendations for future projects.

The recommendations included the following:

- Conduct a thorough house inspection to identify hazardous materials and other issues which should be addressed.
- Carry out an AUDIT2000 computer simulation of the existing house to select the appropriate energy upgrades.
- Develop a specifications and events list that is linked to a construction schedule to assist in anticipating and identifying potential programs.
- Provide training and site supervision to ensure important concepts are fully understood and properly carried out.
- Choose systems and controls that are easy for the homeowner to operate and maintain.
- Monitoring should be kept as simple as possible. Clearly identify the target audience for the monitoring results and clearly define the questions to be answered and the analysis that will be carried out to answer those questions.

RÉSUMÉ

PROJET DE DÉMONSTRATION DE RÉNOVATION DE RED DEER

La *Red Deer Homebuilders' Association* a, en 1994, entrepris la réalisation du *Red Deer Project '94*, un projet de démonstration de travaux de rénovation parrainé conjointement par la Société canadienne d'hypothèques et de logement, le ministère des Ressources naturelles du Canada et l'Association canadienne des constructeurs d'habitations. Les travaux de rénovation, achevés en septembre 1994, concernaient une maison unifamiliale de deux étages que l'on avait construite en 1904. Durant le déroulement des travaux, et après leur achèvement, les membres du projet ont organisé des visites libres et guidées, ainsi que des ateliers, qui ont attiré plus de 1 500 personnes.

La Société canadienne d'hypothèques et de logement a publié, en mai 1995, un rapport décrivant ces travaux de rénovation et contenant des recommandations particulières en vue d'améliorer la future réalisation de tels projets. Au moment de la rédaction du rapport, on n'avait pas encore terminé l'examen de contrôle de la maison rénovée. Le présent rapport vise à fournir les détails de cet examen de contrôle et à donner un aperçu du rendement énergétique de la maison au cours de l'année suivant l'achèvement des travaux.

L'examen de contrôle s'est poursuivi sans arrêt au cours de la réalisation du projet, tout comme après l'arrêt des travaux de rénovation. Cet examen englobait ce qui suit :

- des inspections et des études environnementales avant les travaux;
- des simulations informatiques pour déterminer les améliorations énergétiques à apporter;
- de la documentation relative au processus de sélection des produits;
- la mise en service et la mise à l'essai des systèmes de la maison au moment de l'achèvement des travaux;
- la vérification de la qualité de l'air à l'intérieur de la maison, avant et après l'occupation des lieux;
- la cueillette de données relatives à la consommation du gaz naturel, de l'électricité et de l'eau, et cela pendant la première année d'occupation.

L'examen de contrôle a permis de confirmer la diminution de près de 65 pour cent des besoins en chauffage des locaux, ainsi que l'excellence du bilan en ce qui concerne la qualité de l'air intérieur. On a, par la même occasion, repéré certains points faibles du projet, ce qui a permis d'établir les fondations pour l'élaboration d'un ensemble de recommandations destiné aux futures réalisations.

Au nombre de ces recommandations, mentionnons les suivantes :

- exécuter une inspection élaborée du bâtiment dans le but d'en déterminer les matériaux dangereux et les autres problèmes que devra examiner un entrepreneur qualifié;
- réaliser une simulation informatique du bâtiment existant à l'aide du logiciel AUDIT2000 afin de choisir la méthode appropriée d'amélioration énergétique;
- élaborer une liste des spécifications et des événements se rapportant au calendrier des travaux de construction, liste qui aidera à prévoir et à déterminer les problèmes éventuels;
- assurer la formation et la surveillance des travaux, de sorte que les notions importantes soient pleinement comprises et adéquatement mises en application;
- se tourner vers des systèmes et des commandes que le propriétaire du bâtiment pourra aisément faire fonctionner et entretenir;
- il faudra éviter de compliquer le système de contrôle; déterminer avec précision à qui adresser les résultats obtenus, en plus de définir sans ambiguïtés les questions à examiner et l'analyse à faire pour parvenir à des solutions éclairées.

1. Introduction

In 1994, the Red Deer Homebuilder's Association (RDHBA) was chosen by a selection committee comprised of representatives from the Canada Mortgage and Housing Corporation (CMHC), Natural Resources Canada (NRCan), and the Canadian Home Builders' Association (CHBA) to undertake a 'pilot' renovation demonstration. The renovation project, named *Red Deer Project '94*, was carried out on a two storey, single family dwelling built in 1904. The project commenced in April 1994 and was completed in September 1994. It remained open to the public through October, which coincided with *National Renovation Month*. The Red Deer team held open houses during this time, complete with tours and seminars, which were attended by over 1500 people.

A report on the overall project, including an assessment of the project by the Red Deer team and recommendations for future projects, is detailed in a separate CMHC document[1]. At the time the CHMC report was prepared, the monitoring of the house had not been completed. The purpose of this report is to detail the monitoring that was conducted throughout the project and report on the energy performance of the house over the 1994-95 heating season.

2. Monitoring Prior to Construction

2.1. Site Inspections and Assessment

Prior to starting the renovation, an assessment of the original house was conducted at three levels (see Appendix A):

- a house inspection was conducted by the Red Deer team members;
- a house inspection was carried out by a regional CMHC inspector; and
- a *Level 1 Environmental Audit* was completed by National Building Inspections of Red Deer to provide an historical review and visual site observations.

The house inspections were carried out in order to:

- document the condition of the original house;
- identify existing problems. As a result of the CMHC inspection, for example, it was discovered that the chimney flue was blocked and the hot water heater had been venting into the house.
- identify potential problems areas that required further investigation. The CMHC inspection identified that the wood posts supporting the house may be rotting beneath the slab. Further investigation revealed this to be true and the wood posts were replaced with footings and steel teleposts.
- identify potential upgrades and repairs;
- identify materials which could be salvaged or reused;
- identify hazardous materials, such as those containing lead and asbestos, in order to deal with them in a safe and environmentally friendly manner; and
- provide the information necessary to conduct a HOT2000 computer analysis of the house that would be used to assist in making decisions regarding the upgrades required to meet the R2000 Program energy target.

2.2. Level 2 Environmental Audit

Subsequent to the inspections and *Level 1 Environmental Assessment*, and after consultation with CMHC Ottawa, tests for asbestos, lead paint, and radon were recommended for the *Level 2 Environmental Audit* which was also carried out by National Building Inspections and is included in Appendix B. The main findings of this audit were:

[1]Report on the Red Deer, Alberta, Renovation Demonstration, Red Deer Project '94, May 1995

Asbestos

- The following materials were tested for asbestos:
  * the exterior siding and stucco;
  * the wall insulation in the back porch of the house;
  * the floor tile from the stairs to the second floor and the back porch;
  * the glazing putty in the windows; and
  * the duct tape on the return air plenum in the basement.

- Asbestos was detected in the siding, the putty around the glass and the duct tape. As there is no safe level recommended for asbestos and exposure must be kept as low as possible, a contractor certified and trained in the procedures recommended by Occupational Health and Safety for the handling of asbestos was hired to remove and dispose of materials containing asbestos.

Lead

- The municipal water supply to the house was tested for lead concentrations because the underground service to the house was unknown. The concentration measured was below the maximum acceptable lead concentration for drinking water recommended in the *Guidelines for Canadian Drinking Water Quality*.
- Lead concentrations in the paint were also measured. The highest levels were found on window frames, door jambs and baseboards. All of the windows and many of the door jambs and baseboards were removed and replaced as part of the renovation. Remaining areas were stripped or sealed according to procedures recommended by Occupational Health and Safety.

Radon

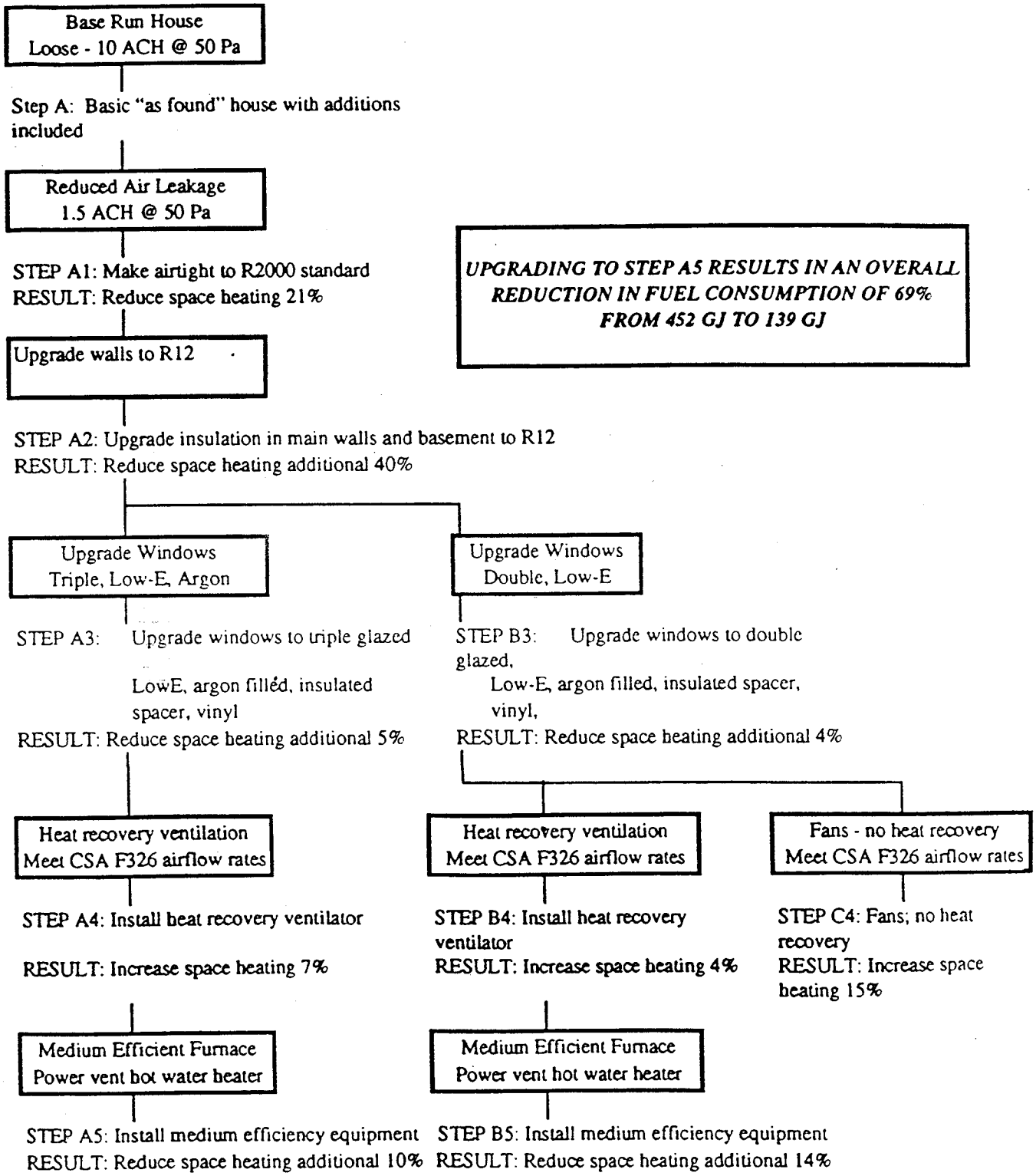
Radon levels in the house basement were below the Health and Welfare Canada acceptable levels.

2.3. Initial HOT2000 Computer Analysis

A computer analysis of the house was conducted using HOT2000 Macintosh Version 6.02 to assist in choosing energy upgrades. A floor plan of the house and an electronic copy of the computer runs are included in Appendix C. The following flow chart shows the effect of various upgrades on energy performance. The actual upgrades chosen are discussed in Section 3.2. The starting point, or *Base Run House*, was the "as found" house and included the proposed additions. The energy consumption of the *Base Run House* was 452 gigajoules (GJ).

Note that each level of the following chart shows the effect of a specific upgrade over and above the upgrades already incorporated into the analysis. Upgrades made through to Step A5 result in reducing gas consumption 69 percent to 139 GJ.

HOT2000 Version 6.02 COMPUTER SIMULATION RESULTS



NOTE: The increase in the fuel bill at Step A4, B4 and C4 results from providing required ventilation air. The amount of the increase is much smaller with heat recovery.

3. Monitoring During Construction

3.1 Specification List

The Red Deer Project '94 Specification List was developed early in the project to assist team members in scheduling the numerous renovation events which were occurring throughout construction. A copy of the specification list is included in Appendix D. The list detailed:

- *Photodocumentation Opportunities* which listed the specific renovation activities that the team was recording on video for local cable television presentation;
- *Educational Opportunities* associated with specific renovation activities which assisted the team in scheduling the education seminars and open houses which were held during the construction period;
- the products being incorporated into the renovation, where they were being used and the reasons for the choice of a specific product.

The specification list became an extremely valuable tool in a number of ways:

- When used in conjunction with the construction schedule, it allowed the numerous project committees involved to organize and direct the areas of the project for which they were responsible.
- It provided the project sponsors in Ottawa with the information they required to ensure that the national objectives for this project were being met.
- It allowed a method to anticipate and identify potential problems associated with specific events and addressed them early in the renovation process.

3.2 Comparison with R2000 Technical Performance Targets

Using the information provided by the HOT2000 simulation, the Red Deer team was able to determine the minimum energy conservation upgrades required to have the house comply with the program's technical requirements in the most cost-effective manner. A review of the specification list, however, revealed that some of the choices made went beyond the minimum requirements. In these cases, the product was donated by a supplier or a manufacturer who wanted to showcase the product and the company in the renovation.

From the specification list, it can also be seen that the renovation went far beyond the minimum indoor air quality and environmental requirements by choosing products that satisfied almost all the choices offered in the R2000 and the CMHC Healthy Housing technical requirements.

The following energy conserving upgrades were made to the house:

- The exterior walls of the existing house were blown with cellulose fibre insulation.
- Triple low emissivity (Low E), argon-filled glazing units with an insulated spacer bar installed in vinyl frames were donated to the project. Otherwise, a similar energy efficient double glazed unit in vinyl frame would have been specified.
- A heat recovery ventilator was chosen over a non-heat recovery system because this type of system is currently the most effective way to provide whole house ventilation in a controlled and comfortable manner.
- A high efficiency, condensing furnace was donated to the project. Otherwise, the high efficiency furnace would probably not have been chosen over a medium efficiency unit because of the higher initial cost and the long payback. The existing mid-efficiency gas furnace in the house was removed and reused elsewhere.
- A higher efficiency, power-vented hot water heater was selected to ensure that backdrafting would not be a concern in the house.
- As a result of the choice of these mechanically vented induced draft gas appliances, there was no need to provide makeup air in accordance with the CSA F326 standard[2].

[2]Canadian Standards Association standard *CAN/CSA-F326-M91, Residential Mechanical Ventilation Systems*

Once the house was completed, it achieced the following performance targets relative to the R2000 performance targets:

- The estimated energy consumption is greater than the R2000 energy target. This was due mainly to the fact that the stud cavity of the existing house could only accommodate RSI 2.1 whereas the minimum R2000 requirement above grade for this degree day location is RSI 3.6.was 4.1 air changes per hour (ACH). The R2000 target is 1.5 ACH at 50 Pascals. The air exchange rate of the original house was 18.7 ACH.

  Although a specific leakage area could not be found, leakage under the baseboards and through interior wall electrical outlets on the second floor suggested that the second floor rim joist area and perhaps the ceiling, were the major sources of air leakage. Difficulty in sealing balloon framing details of the original house would appear to be the cause for these leakage problems.

4. Monitoring After Completion

4.1. Energy and Hot Water Consumption Monitoring

The natural gas, electricity and water consumption of the renovated house were monitored using the utility company meters and a number of submeters. Meter readings were recorded monthly by the homeowner (see Appendix E).

As a result, consumptions could be determined for:

- total natural gas, electricity and water;
- natural gas for space heating;
- natural gas for domestic hot water (DHW) heating; and
- domestic hot water, cold water and outside water consumption.

4.1.1. Energy Consumption Comparison

In order to compare consumption data before and after the renovation, the natural gas, electricity and water billing histories for the house prior to the renovation were obtained from the local utilities (see Appendix E). A comparison of actual consumptions for the original house during the year prior to the renovation (*Pre-RENO*) with the actual monitored consumptions of the renovated house during the year after the renovation (*Post-RENO*), and the results of the AUDIT2000 computer simulation are shown in Table 1.

Table 1: Comparison of Energy and Hot Water Consumptions

	Natural Gas Consumption			Total	Domestic
	Space (GJ)	DHW (GJ)	Total (GJ)	Electric (kWh)	Hot Water (L/da)
Pre-RENO	na	na	210	5,882	na
Post-RENO	82	41	123	11,942	292
AUDIT2000	91	34	125	11,977	292

Comments on Table 1

- All of the *Post-RENO* values were determined using the monitored data.
- The AUDIT2000 program over-predicted the space heating natural gas consumption by 10 percent and underpredicted the DHW natural gas consumption by 16 percent. The total predicted natural gas consumption was almost identical suggesting the house has been modeled fairly accurately.
- Estimates of electricity consumption were adjusted in AUDIT2000 until the predicted consumption matched the actual consumption. (see Section 4.2.1)
- The domestic hot water consumption determined from the monitored data was input directly into AUDIT2000 and reflects the hot water use of 4 adults in the house 75 percent of the time. The default value for AUDIT2000 is 225 Litres per day (L/da) and assumes an occupancy of 2 adults and 2 children 50 percent of the time.
- In addition to the hot water use, 587 Litres per day (L/da) of cold water was used and a total of 78 cubic meters of water was used outdoors during the *Post-RENO* year of monitoring.

4.1.2. Normalized Energy Consumptions

In order to account for differences in the size of the house, climatic conditions and occupancy prior to, and after, the renovation, the consumption data was normalized and then compared in Table 2. Normalized data indicates that the total natural gas consumption of the renovated house was reduced 65 percent.

Table 2: Comparison of Normalized Consumptions

	Heating Degree-Days (DD)	Heated Area (m2)	Natural Gas Consumption			Total Electric (kWh/occupant)	Domestic Hot Water (L/da/occupant)
			Total (GJ)	Normalized (MJ/m2)	Normalized (MJ/m2/DD)		
Pre-RENO	5,784	155	210	1,353	234	na	na
Post-RENO	6,062	258	123	478	79	2,986	73

Comments on Table 2

- The closest weather location to Red Deer in AUDIT2000 was Rocky Mountain House, 86 kilometers to the west. The 30 year average for heating degree-days at this location is 5550. The degree-day values shown in Table 2 are the actual heating degree-days obtained from Environment Canada.
- The heated area includes the basement and crawlspace areas.
- *Total Electric* and *Domestic Hot Water* consumptions prior to the renovation could not be normalized since occupancy patterns were not known.

4.2. AUDIT2000 Computer Simulation

An AUDIT2000 computer simulation was carried out on the occupied *Post-RENO* house. In order to obtain the additional information required to conduct the simulation, a field audit of the house was conducted using the protocol specified in the *AUDIT2000 Field Manual: Version 2.01*. The field data was input into the program and adjusted as required to bring the AUDIT2000 predictions in line with the monitored data. The following changes were incorporated into the simulation:

- The monthly mean dry bulb temperatures in the Rocky Mountain House 30 year average weather file were replaced with actual dry bulb temperatures for the *Post-RENO* period obtained from Environment Canada.
- The CGSB[3] blower door test result on the completed building was input into the program (see Appendix E).
- A continuous ventilation rate lower than the F326[4]rate was input into the program since it was deemed to more closely reflect actual system operation.
- The two largest electrical consumers, the exterior block heaters and the space heating fan, were adjusted based on input from the occupants and the expertise of the field auditor until the predicted electrical use matched the actual consumption.

4.2.1. AUDIT2000 Simulation Result

The full output results of the AUDIT2000 computer simulation are presented in Appendix E. The following points should be noted:

- The estimated annual space and DHW consumption is greater than the R2000 energy target. From Table 3, it can be seen that the largest component heat losses from the renovated house are still from the main and second floor walls and from the overall natural and mechanical house ventilation.

[3]Blower door testing standard *CAN/CGSB-149.10-M86: Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method*

[4]Ventilation rates established by the Canadian Standards Association in the standard *CAN/CSA-F326-M91, Residential Mechanical Ventilation Systems*

Table 3: Component Heat Loss

Computer Simulated Heat Loss	Main and Second			Basement		Infiltration/ Ventilation (GJ)
	Ceiling (GJ)	Walls (GJ)	Windows (GJ)	Walls (GJ)	Floor (GJ)	
Base Run House	9	88	41	23	19	72
AUDIT2000	7	53	18	14	16	37
Reduction	28%	40%	55%	40%	17%	49%

- The high wall heat loss is due mainly to the fact that the stud spaces of the existing house could only accommodate RSI 2.1. The high ventilation heat loss is due partly to the fact that the air leakage across the building envelope at a depressurization of 50 Pascals was 4.1 air changes per hour (ACH) which is significantly higher that the R2000 program requirement of 1.5 ACH. When the minimum R2000 Program insulation level of RSI 3.6 for above grade walls and a blower door test result of 1.5 ACH are input into AUDIT2000, the estimated annual consumption drops below the R2000 energy target.
- Using field audit information for electrical consumption in the *Post-RENO* house, AUDIT2000 predicted the base load consumptions shown in Table 4.

Table 4: Electrical Base Load Consumption

Base Load	kWh/day		% of Total
Interior - Lighting	1.8	651	5
- Appliances	4.2	1527	13
- Other	5.6	2051	17
Exterior use	7.9	2877	24
HRV fans	3.7	1367	11
Space heating fan	9.6	3504	29

- Note that 40 percent of the total electricity is consumed by the space heating fan and the heat recovery ventilator (HRV) fans. The space heating fan consumption is high due to the continuous fan operation required to circulate ventilation air throughout the house. A dedicated ducting system for the HRV would significantly reduce the cost of operating the space heating fan.
- The high exterior electricity consumption is due to block heaters use. Timers would significantly reduce this consumption.
- The lighting consumption of 1.8 kilowatt-hours per day (kWh/day) can be compared to the AUDIT2000 default of 3.0 kWh/day. Energy efficient lighting fixtures and bulbs were installed in a number of locations in the house.
- The appliance consumption of 4.2 kWh/day can be compared to the AUDIT2000 default of 14 kWh/day. Appliances in the top one third of the Energuide rating were selected for this house.
- The *Other* consumption of 5.6 kWh/day can be compared to the AUDIT2000 default of 3.0 kWh/day. There are 3 colored televisions operating in this house an average 12 hours each per day.

4.2.2. Using AUDIT2000 as a Design Tool

AUDIT2000 provides a tool for the comprehensive technical modeling of the "house as a system" which allows the user to:

- determine the interactive effects between the various sub-systems within a house;
- to determine the energy use of major electrical consumers in the house; and
- evaluate the impact of upgrade measures to the building envelope, the installed equipment and occupant behavior on the energy consumption of the house and determine the cost effectiveness of the energy conservation measures.

As demonstrated in the previous section, the AUDIT2000 results provide an indication of the house components which are contributing the greatest to the home's heat loss and electricity consumption. As a result, the user can immediately see the effects of changing insulation levels, choosing a different heating or ventilation strategy, selecting different appliances or operating the house in a different manner. This becomes extremely important for the homeowner with a limited budget who would like to make the greatest impact for the dollars that will be spent.

Examples of changes that could be evaluated with the program include:

- installing a high efficiency motor, or an electronically commutated motor (ECM). Although there will be a higher initial capital cost for such equipment, the electrical savings resulting from having to operate the fan continuously may result in a payback period short enough to make the initial investment attractive.
- installing a dedicated ducting system for the HRV. The payback of the initial cost of the ducting with the electricity savings from not having to run the furnace fan continuously could be determined.
- installing blockheater timers to reduce electricity consumption.

One of the most important points to remember about the AUDIT2000 program is that the quality of the information provided by the program depends entirely on the quality and level of detail of the information input into the program. The more accurately the systems of the house can be modeled, the greater will be the accuracy and value of the program results to the user.

4.3. Indoor Air Quality

Indoor air quality measurements were carried out before and after the house was occupied. The following measurements were conducted:

- formaldehyde (HCHO) levels in the second floor hallway and main floor living area using passive dosimeters supplied by ORTECH Corporation;
- volatile organic compound (VOC) levels in the main floor living area using passive monitors supplied by Concord Environmental;
- main floor particulates using equipment supplied by ORTECH Corporation;
- biologicals using equipment supplied by the University of Alberta; and
- passive air infiltration rates (PFT) using the AIMS technology from Brookhaven National Laboratories;

The unoccupied testing was carried out in November 1994 and the occupied testing was conducted in mid-December. The test results in Table 5 indicate that good indoor air quality is being achieved in the house which can be attributed directly to the operation of the ventilation system.

Table 5: Indoor Air Quality Results

	Formaldehyde		Particulates	Biologicals		Passive Air Infiltration	Volatile Organics (VOC)	
	Second	Main		Inside	Outside		Concentration	Source
	(ppm)		(µg/m3)	(cfu/m3)		(ACH)	(µg/m3)	(mg/h)
Before	<.01	<.01	10	NA	NA	0.32	188	37
After	<.01	<.01	30	13	144	0.69	190	81
Targets	0.05		40	50	150	Compared to Occupied R2000		
(HWC)						0.28	311	69

Formaldehyde

The Health and Welfare Canada (HWC) exposure guidelines for formaldehyde in residential indoor air are:

ACTION LEVEL: 0.10 ppm TARGET LEVEL: 0.05 ppm

The Red Deer house did not exceeded the *Target Level* before or after occupancy.

Volatile Organic Compounds (VOC)

A speciated VOC analysis determined concentrations for a target list of 26 indoor VOCs established HWC. The detailed results of these tests are presented in Appendix E. The sum of the 26 individual VOC concentrations is presented in Table 5. VOC source strengths were determined using the VOC concentrations and the passive air infiltration results. The following points should be noted:

- Acceptable VOC levels for residences have not been established by HWC and results can only be compared with other studies. In Table 5, the Red Deer results are compared to an audit study[5] recently completed by NRCan.
- The source emissions indicate the amount of VOCs that are introduced into the indoor environment each hour. This figure more than doubled after occupancy indicating relatively high emissions from the household and personal effects moved into the home by the occupants.
- The results are comparable to occupied R2000 homes previously studied.

Particulates

The levels in the Red Deer house were below the acceptable exposure levels for fine particulate matter established by HWC.

Biologicals

The levels in the Red Deer house were below the levels of 150 cfu/m3 of mixed species and 50 cfu/m3 of a single species adopted by HWC. The area sampled indoors was considerably lower than outdoor levels indicating effective supply and filtration of the ventilation air. A more detailed report is included in Appendix E.

4.4. Electromagnetic Field Survey

An electromagnetic field survey was carried out by National Building Inspections. The purpose of the survey was to provide spot measurements of the ambient 60 Hertz magnetic flux densities of various rooms and appliances in the renovated house. The report indicated that all of the "center-of-the-room" readings, with the exception of the kitchen, compared favorably with the Electric Power Research Institute's report of 0.35 milligauss as the median residential exposure level from power lines. A copy of the report is included in Appendix E.

4.5. Recommendations for Future Renovation Demonstration Projects

- Become thoroughly familiar with the results and conclusions of projects already completed by CMHC, NRCan and CHBA in order to build upon the knowledge that has already been gained and will apply directly to any new project. Too often, the tendency is surge forward with ideas based on past experience alone rather that combining experience with current knowledge.
- Conduct a thorough inspection and assessment of the house and site. Identify hazardous materials, such as asbestos, which will have to be dealt with by a certified contractor.

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[5]Efficiency Housing Database Development: Field Energy Audit of Existing Dwellings Phase 2: Audit of New Conventional and R2000 Houses in Alberta, September 1994.

- Conduct a full AUDIT2000 field audit of the existing house to be renovated using the protocol established in the *AUDIT2000 Field Manual.* Use the economic analysis features of AUDIT2000 to determine the economic performance of different energy conservation investments. An assessment of both the initial capital costs, and the operating and maintenance costs are required in order to properly evaluate which energy conservation features to select.
- Develop a specifications and events list that is linked to a construction schedule. This will allow team members to schedule the numerous renovation events that will be occurring throughout the project. Such a list will serve as an invaluable tool for anticipating, identifying and dealing with potential problems. In addition, this documentation will provide a detailed record of the entire renovation process with will be essential for any reporting required for project.
- Weekly meetings and/or conference calls between the project team and the program authority are essential to ensure the consistent flow of information and ideas required to make the renovation project a success.
- Provide the training and site supervision necessary to ensure that concepts such as air sealing are fully understood and properly carried out.
- Choose systems and controls that are easy for the homeowner to operate and maintain. For example, furnace thermostats and HRV controls are available that have maintenance lights which indicate that maintenance and/or servicing is required.
- Once the renovation has been completed, ensure that all house systems are commissioned and that the homeowner has been instructed on how to operate and maintain them. Written documentation that the homeowner can refer to at a later date and pass on to new owners would be ideal.
- Any monitoring carried out in the house should be kept as simple as possible. Clearly define the target audience(s) for which the results of the monitoring program are intended, and fully detail the questions that are to be answered and the analysis that will be carried out to answer those questions.

  Data collection and the subsequent analysis of the monitored data can be very expensive and should never be carried out on an "it would be nice to know" basis. Concentrate the monitoring on innovative products, equipment and/or systems used in the home for which good field operating data and experience may not have been accumulated.

APPENDIX A

1. Renovation Team's House Inspection Report
2. CMHC Inspection Report
3. Level 1 Environmental Audit

howell·mayhew engineering, inc.

15006 · 103 AVENUE
EDMONTON · ALBERTA · T5P 0N8
(403) 484·0476

AIR LEAKAGE TEST REPORT

May 6, 1994

Name: Red Deer Renovation Address: Red Deer

Technician: W. Mayhew Project: Project '94

Volume = 395 m^3 Envelope Area: na m^2

House pressure:
Initial = 0 Pa
Final = 0 Pa
Backgrnd = 0 Pa

Comments on the wind speed: 10 km/h
Barometric pressure = 92.92 kPa
Indoor air temperature = 16 °C
Outdoor air temperature = 16 °C

Reading #	Measured house pressure (Pa)	Corrected house pressure (Pa)	Fan pressure (Pa)	# holes plugged (-1=open)	Corrected Flow (cfm)	Maximum Error (must be < 6%) (%)
1.	51	51.0	112	-1	3717	1.9
2.	46	46.0	90	-1	3352	1.6
3.	40	40.0	75	-1	3075	.9
4.	36	36.0	65	-1	2874	.7
5.	30	30.0	50	-1	2538	1.1
6.	26	26.0	43	-1	2364	1.3
7.	22	22.0	34	-1	2115	1.3

Air Leakage Test Results

C = 269.1 r = .997 (must be > 0.990)

n = .663 (between 0.5 and 1.0) RSE_{10} = 3.2% (must be < 7%)

Q_{50} = 3599 cfm Air $Change_{50}$ = 15.48 per hour
Q_{20} = 1961 cfm
Q_{10} = 1238 cfm Normalzed Leakage Area = na cm^2/m^2 (must be<0.7)
Q_5 = 782 cfm Equivalent Leakage Area = 364 in^2 at 10 Pa
Equivalent Hole Diameter = 21.5 in

Comments: (Major leakage sites, recommendations...)

This test does not include the front and back porches.

howell·mayhew engineering, inc.

15006 · 103 AVENUE
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(403) 484·0476

AIR LEAKAGE TEST REPORT

May 6, 1994

Name: Red Deer Renovation Address: Red Deer

Technician: W. Mayhew Project Name: Project 94

Volume = 440 m^3 Envelope Area: na m^2

House pressure:
Initial = 0 Pa
Final = 0 Pa
Backgrnd = 0 Pa

Comments on the wind speed: 10 km/h
Barometric pressure = 92.92 kPa
Indoor air temperature = 16 °C
Outdoor air temperature = 16 °C

Reading #	Measured house pressure (Pa)	Corrected house pressure (Pa)	Fan pressure (Pa)	# holes plugged (-1=open)	Corrected Flow (cfm)	Maximum Error (must be < 6%) (%)
1.	49	49.0	200	-1	4890	2.2
2.	44	44.0	160	-1	4400	1.4
3.	40	40.0	140	-1	4131	1.6
4.	36	36.0	125	-1	3915	.1
5.	32	32.0	105	-1	3606	.8
6.	26	26.0	80	-1	3170	.3
7.	19	19.0	55	-1	2655	2.2

Air Leakage Test Results

C = 388.8 r = .996 (must be > 0.990)

n = .645 (between 0.5 and 1.0) RSE_{10} = 3.5% (must be < 7%)

Q_{50} = 4846 cfm Air $Change_{50}$ = 18.73 per hour
Q_{20} = 2684 cfm
Q_{10} = 1716 cfm Normalzed Leakage Area = cm^2/m^2 (must be<0.7)
Q_5 = 1098 cfm Equivalent Leakage Area = 504 in^2 at 10 Pa
Equivalent Hole Diameter = 25.3 in

Comments: (Major leakage sites, recommendations...)

This test includes front and back porches.

RENO DEMO

RED DEER PROJECT '94
HEALTHY HOUSING THROUGH RENOVATION

INSPECTION REQUEST AND LIMITATIONS:

An inspection was completed at the request of Housing Innovation Division of Canada Mortgage and Housing Corporation on the site and improvements at:

4725 - 56 street
Red Deer Alberta.

A non-destructive inspection was completed on May 30, 1994 and is limited to:

: the present structural condition,
: the life expectancy of the major components,
: any fire, health and safety concerns,
: the level of energy conservation,
: any concerns with proposed upgrades and addition.

A set of plans (no specifications) were received on June 13, which were reviewed and comments pertaining to these plans are also included.

Materials observed and room sizes are also noted to assist in future costing and decision making. All dimensions are in inches unless otherwise noted.

../2

INDEX

.../3

1.0 **BUILDING DESCRIPTION:** This single family dwelling has a 27 by 22 foot two storey main structure. The present wood balloon frame building is supported on a concrete foundation wall with primarily stucco exterior and shingled roof.

According to City records the unit was originally constructed in 1905 and the foundation was likely supported on grade (crawl space only). In the late 1940's the unit was added to and upgraded. Part of the upgrade appears to have been the addition of a full foundation, plumbing and electrical services and a rear porch (5 feet by the full width).

The front porch (approximately 7½ by 12½ feet) was likely originally constructed as an open veranda and this was closed in at some later date.

2.0 **INSPECTION REPORT:**

.1 **SITE:** The site is located in a well established area of Red Deer known as "Waskasoo" in close proximity to the river but well above it's flood plain. The area has houses ranging from originally constructed units, such as this house, (worth approximately 100,000 dollars), to lots which have had the original houses torn down and replaced with new structures (worth approximately 250,000).

The streets in this area are paved, and the lane behind this unit is also paved although it is in deteriorated condition. There are single family dwellings units on the adjacent lots, with low-rise apartments across the lane from this site.

The 50 by 200 foot lot has a minimal number of mature trees, limited amount of flowering plants with the remainder being covered with lawn. Some of the trees are in contact with the house primarily the roof.

The grading around the house is negative in certain locations.

.2 **BUILDING ENVELOPE:** The original (1905) exterior wall finish of the main part of the structure is of a clay type brick which was stuccoed over as part of the 1940 renovation. This stucco is still in place today with little evidence of concern to its serviceability. Inside the brick is a 2 by 4 frame wall which amounts to a total wall assembly of approximately 11 inches in thickness.

The front and rear porches appear to have stucco only on them and there are some cracks evident especially at the joints to the main structure.

../5

.2 BUILDING ENVELOPE (con't):

The gable end and upper part of the second storey walls have been built out (approximately 16") almost flush with the overhang covered with what appears to be a ~~slate~~ CEMENT tile which was commonly used in this area in the 1940's.

All roof areas are presently covered with asphalt shingles although it is assumed that the original finish was a wood shingle.

There is eavestroughing in place but in questionable condition. In addition there are some downspouts missing.

The two window wells along the east side of the house have had a concrete cap installed over them.

.3 BUILDING INTERIOR:

.1 GENERAL: The construction materials used are typical for the time and the finishes throughout the unit are fairly uniform from one room to another. All finishes are be as listed here unless otherwise noted.

.1 Windows - the windows are double hung check rail windows (sizes listed are inside frame dimensions). Most of these have some damaged glass, sashes and frames. Most also have a wood window sill embedded into the brick exterior finish. These have some evidence of minor rotting as well. These assemblies would be considered very inefficient.

.2 Exterior doors - vary, see entry hall and back porch for comments.

.3 Walls and ceilings - areas are finished with a plaster and lathe. These have all been painted with some covered with wall paper. Since many of the coats of paint were installed prior to 1980, it should be cautioned that the paint contains lead.
The wall cavities contain no insulation and the only vapour barrier would be the painted surface.

.4 Flooring - the flooring changes from room to room and is described below. The upper stairs is covered with a vinyl ~~asbestos~~ tile, and it is likely that the other areas presently with sheet vinyl flooring have some ~~VA~~ tile under it as well.

.5 Interior doors - most doors are panelled, style and rail doors 78 inches in height. A lot of them still have original hardware, and are painted. (see paint caution noted under walls)

.6 Trim - wide colonial type window and door trim. The base trim is approximately ¾ by 6 inch in size.

.../6

.2 **MAIN FLOOR:** This floor includes the front porch, entry hallway and stairwell, living room, dining room, kitchen and back porch. Room heights are 107 inches (except the back porch) and descriptions are as follows with concerns listed as part of the comments (the abbreviation WA is warm air, with RA being return air)(* indicate items which should be considered for repair):

LIVING ROOM:

Room size: 161 x 157	Door: archway to entry and dining
Closet size: nil	Door: nil
Window size: 52x66 frt & 30x66 side	Lighting: center ceiling light
Duplex receptacles: 2	Flooring: Serviceable hardwood
Wall finish: 3 walls papered, rest painted	Ceiling finish: textured
Heating: 1 WA. 1 RA.	Other: WA common to entry hall

Comments: Switch for light located in entry hall.

DINING ROOM:

Room size: 141 x 103	Door: archway to kitchen & living
Closet size: nil	Door: nil
Window size: 30 x 66	Lighting: center ceiling light
Duplex receptacles: 1	Flooring: serviceable hardwood
Wall finish: 1 wall papered, others painted	Ceiling finish: textured
Heating: 1 WA. 1 RA.	Other: WA common to kitchen, RA in floor

Comments: Receptacle located in basetrim.

KITCHEN:

Room size: 147 x 140	Door: to bsmt 32 x 78 c/w window
Closet size: nil	Door: nil
Window size: 30 x 66	Lighting: center ceiling light
Duplex receptacles:see com.	Flooring: newer sheet vinyl
Wall finish: walls painted	Ceiling finish: painted

.../7

KITCHEN (con't):

Heating: 1 WA. 1 RA.	Other: WA common to dining

Comments:

There is a 30 inch door to the back porch. Light switched by back door only. Flooring installation is of lesser quality and it appears that there are several additional layers under this layer.

Receptacles - one behind fridge, one counter plug, one plug by ironing board, one above stove, 220v plug for stove.

Cabinets are 24" deep (with single stainless steel sink) by 93" at 34" high, 16" plastic laminate splash, 42" upper cabinets. A poor 24 x 17 inch pantry type cupboard was constructed in the corner by door to the back porch. All cabinets appear to be constructed of plywood.

* A 12 x 47 inch ironing board cabinet has been built into an exterior wall stud space. The plastic laminate is separating from counter top.

ENTRY HALLWAY/STAIRWELL:

Room size: 53 x 157	Door: 34 x 82 x 1¾ door with wind.
Closet size: nil	Door: nil
Window size: nil	Lighting: 1 light on 3-way
Duplex receptacles: nil	Flooring: ~~V~~ tile and short shag carpet
Wall finish: 1 wall papered, 1 see comments.	Ceiling finish: painted
Heating: 1 WA. 1 RA.	Other: WA common to living room

Comments:

Door is to front porch and has 23 x 22 lite. Furnace thermostat is located in hallway with electrical panel located in stud space of the outside wall above landing. Bottom 36 inch of the wall common to the living room is panelled, above this and the other wall are papered.

Stairwell has 12 steps from the upper hallway to a 33 by 36 inch landing to another step and then into the entry hallway. Vinyl ~~asbestos~~ tile with rubber nosings cover the upper stairs; Landing, lower stair and hallway have short pile carpet.

* Entry door has in-effective weatherstrip and glass is single pane.

Warm air outlet and return air inlet are located in close proximity to each other.

BACK PORCH/STORAGE ADDITION:

Room size: 61 x 21 ft 6	Door: ext, 30 x 78 x 1 3/8 plywood
Closet size: east 91" is store room	Door: 28 x 76 x 1 3/8 with wind.
Window size: each 30 x 66	Lighting:1 on switch, 1 pull chain

.../8

BACK PORCH/STORAGE ADDITION (con't):

Duplex receptacles: 2	Flooring: old thin glue down carpet	
Wall finish: painted ~~ton-test~~ FIBERBOARD		Ceiling finish: same
Heating: 1 WA.	Other:	

Comments: A third door leads to the kitchen area. Some cabinets of poor quality in place. Some of the ~~ton-test~~ FIBERBOARD was installed over the original plaster lathe.

* Some evidence of mold growth in the storage area. The exterior door has no storm or weatherstripping.

FRONT PORCH:

Room size: 82 x 138		Door: 34 x 82 storm door with lite
Closet size: nil		Door: nil
Window size: 98 x 48		Lighting: 1 switched light
Duplex receptacles: nil	Flooring: old thin glue down carpet	
Wall finish: plaster/stucco		Ceiling finish: same
Heating: nil	Other:	

Comments:

* Window (three) is single pane only. Door light is approximately 26 x 47 inches in size and the bottom mutton bar is missing; also door has no weatherstripping or even a threshold.

.3 **SECOND FLOOR:** This floor includes a hallway, three bedrooms and a bathroom. Room heights are 101" and description is as follows:

MASTER BEDROOM:

Room size: 137 x 137		Door: 30 x 78
Closet size: 41 x 33		Door: 29 x 78
Window size: 30 x 62		Lighting: nil
Duplex receptacles: 2	Flooring: newer short shag carpet	
Wall finish: 2 walls papered, rest painted		Ceiling finish: painted
Heating: 1 WA. 1 RA.	Other: WA common to bathroom	

Comments:

* Door has been kicked in resulting in a cracked panel and jamb.

.../9

HALLWAY:

Room size: 181 x 41	Door:included with individual rooms
Closet size: 22 x 29	Door: 24 x 78
Window size: nil	Lighting: 1 light on 3-way
Duplex receptacles: nil	Flooring: short pile, direct glue type
Wall finish: painted	Ceiling finish: painted
Heating: nil	Other:

Comments:
Light common to light and switch in entry hall.
* No smoke detector in place. Shelving in closet is poor.

BEDROOM #2 (back east):

Room size: 115 x 115	Door: 30 x 78
Closet size: 42 x 36	Door: 28 x 68
Window size: 30 x 62	Lighting: nil
Duplex receptacles: 2	Flooring: sculptured cut and loop
Wall finish: 2 walls papered rest painted	Ceiling finish: painted
Heating: 1 WA. 1 RA.	Other: WA common to common to other bedroom

Comments:
Closet door is painted mahogany slab door likely installed at the time of fire repairs.
* Ceiling in closet is not finished.

BEDROOM #3 (back west):

Room size: 135 x 115	Door: 30 x 78
Closet size: 20 x 34	Door: 24 x 74
Window size: 30 x 62	Lighting: nil
Duplex receptacles: 2	Flooring: short shag carpet
Wall finish: all walls painted	Ceiling finish: painted
Heating: 1 WA. 1 RA.	Other: WA common to other bedroom

Comments: The closet was installed after original construction as with the door which is painted mahogany slab door.

.../10

BATHROOM:

Room size: 105 x 67 plus 29 x 46	Door: 24 x 78
Closet size: nil	Door: nil
Window size: 30 x 62	Lighting: wall light
Duplex receptacles: 2	Flooring: 12 x 12 self-adhesive tile
Wall finish: all walls painted	Ceiling finish: painted
Heating: 1 WA.	Other: WA common to master bedroom

Comments:
Wall light has ungrounded shaver plug-in controlled by wall switch in the hallway. Warm air grill is in the floor.
Bath is free standing cast iron tub with shower head. Wrap around curtain on metal track forms shower enclosure. Basin is cast iron and wall hung. One set of water lines come up through the floor at the bathtub and surface run lines service the other fixtures.
Main stack runs up in the corner behind the water closet and finish covering it is poor.
* Passage door is painted "home made" slab door replacing the original.

.4 **BASEMENT/FOUNDATION:** The foundation of this unit appears to have 8 inch, except the rear wall which appears to be 10 inches thick, poured in place concrete walls. These walls sit on a footing approximately 20 x 7 inches in size. There were originally two windows with 8 inch poured lintels over them, but these windows have since been removed and the openings filled in with concrete.

There is no evidence of reinforcement in the foundation walls, nor was it "standard construction" at the time to include rebar.

The interior dimensions are 21'7" x 25'5" x 7'3". The concrete walls have no interior dampproofing, no insulation installed on them and are unfinished. It is also assumed that the exterior was not dampproofed.

The foundation appears in good condition considering the age with only one minor crack evident. There is also a small area near grade level along the stairs that has spalled. Both locations show no signs of water entry at this time.

The floor consists of a layer of brick with a 2 inch cap of concrete poured over it. Again no evidence of any dampproofing or gas sealing being in place and in fact an area approximately 8 feet square has no floor in place.

.../11

.4 **BASEMENT/FOUNDATION (con't):**

The center built up beam is three 2 x 10's supported on three 2 x 6 wood columns located at 100, 170 and 285 inches measured from the front of the basement. There is evidence of minor rotting at the base of the columns where they are poured into the concrete. The column footing size is not known.

Joints in the beam occur above the supports or near the quarter points. There is some wall framing under this beam near the furnace, but this would not be considered structural since it is likely there is no footing under it.

The beam appears to have been installed after the construction of the foundation since the ends are not poured in place. The front of the beam supports on a 2 - 2 x 8 column and the rear stops 13 inches short of the back wall. Beam is out of level approximately ½ inch.

A 2 x 6 mud sill supports a 2 x 10 one piece floor joist system with center cross bridging. The exterior wall studs come down alongside the floor joists typical of the balloon framing and as a result there is no perimeter header joist. Floor sheathing consists of ¾" rough boards 6 to 10 inches in width. Floor joists are doubled around the 94 by 36 inch stair well opening, but no joist hangers were installed. Very little settlement of tail joists noted.

The front and rear porch both appear to have surface foundations only. This type of system would continually move from frost etc. and result in stress fractures in the areas were it attaches to the main portion of the building. This generally results in water entry problems both at the connecting roof line and at the wall intersections.

.5 **ATTIC:** The attic over the main part of the structure is large because of the 12 and 12 roof slope. The ceiling joists are 2 x 4's as are the rafters; all 16 inch on center. Roof sheathing is rough ¾" boards varying in width. Rafters have no collar ties installed.

Insulation consists of 3 inches of zonolite and an R-20 fiber glass batt. The access is small and the cover is plywood only with no insulation or weatherstripping.

There is no venting evident in the attic space although there is holes in the flashing around the chimney.

It is evident that a fire has occurred in the area over the back east bedroom. It scorched the rafters and roof sheathing, and necessitated the replacement of the ceiling "plaster and Lathe" finish in the back east bedroom. Precise cause is unknown, but the brick chimney is suspect because it also has been replaced.

.../12

.6 **MECHANICAL SYSTEMS:**

.1 Electrical - The 16 circuit electrical panel has a 100 amp main breaker and is mounted in a stud space of the exterior wall. Six 15 amp circuits supply the power and lighting needs with two additional 220 breakers suppling the dryer and stove. There is some evidence of "tube and knob" wiring in both the basement and the attic, but I was unable to determine if these are still in use.

Most of the wiring has been upgraded, but some open junction boxes were observed. Also the furnace electrical is not on a separate breaker. Loose wiring was observed in the basement.

.2 Plumbing - Domestic hot water is supplied by an old 33 gallon gas hot water tank.

The municipally supplied water source enters by means of a ¾" copper line. The water lines in the unit are almost all ½" galvanized, and would very likely have calcium build-up in them resulting in lines of less than half that size.

The main soil drain is a 4 inch cast line in the front corner of the basement. Laundry hook-up is into the floor drain near the base of the stairs. The clean out cover at the base of the main stack has a hole in it.

The kitchen drain has been improperly redone in ABS with drain line not adequately sloped and sink is not vented.

.3 Heating - Space heating is supplied by a mid-efficiency 112,500 BTU naturally aspirated natural gas furnace with an electronic ignition. This furnace appears to be less than 5 years old and replaced the original gravity furnace.

The entire heating system is of a poor design. The return air is being drawn down from the upper floor into the basement by means of a stud cavity in the outside wall; and the warm air is being supplied from an interior wall. Several room registers are installed back to back resulting in an inefficient system as well as a lot of sound transfer. The duct work is also poorly designed partially due to alterations made during the replacement. Some duct take-offs have been installed on the bottom of the duct, and several have been installed in the plenum.

Only one main warm air duct (16 by 8) was installed. Warm air distribution is as follows:

: a 5" plenum take-off supplies the back porch addition,
: a 5" plenum take-off supplies the kitchen/dining rooms,
: a 5" plenum take-off supplies the back two upstairs bedrooms
: a 7" take-off from the bottom of the duct supplies the entry hall and living room
: a 7" take-off from the bottom of the duct supplies the master bed and the bath room on the second floor
: a 5" duct take off for the basement

.../13

Return air is supplied from all rooms except the rear porch, entry hall and the bathroom. The return air is collected into a 14 by 8 duct, transfers to a 18 by 8 drop, then a 18 by 8 duct laying on the concrete floor.

A 5 inch fresh air duct is tied into the return air duct. No combustion air was installed. No humidifier was installed on the heating system. Some of the joints in the old ducts/pipes have an asbestos tape on them.

The vent of the hot water tank connects to the unlined brick chimney below the entrance of the furnace. This vent was almost totally blocked by soot deposits and would be considered hazardous.

The dryer is being vented directly into the basement area.

The gas meter is located in the basement. The gas line varies in size and has been altered many times resulting in a line much longer than necessary with many elbows and abandoned portions. There is also a capped line going back through the foundation wall which presumably supplied the garage at some time.

.7 ANCILLARY STRUCTURES:

.1 Fencing - The majority of the fencing is limited to the rear yard and would be summarized as follows:
: the west side of the back yard line has a chain link fence,
: the rear fence is at the front side of the garage, encompasses a double parking stall and then jogs back to near the property line. This fence is of vertical wood construction and appears to be in reasonably good condition.
: east fence is of horizontal wood design and appears to be in poor condition.

.2 Walkways - The front walk to the unit is 24 inches in width, with a 20 inch walk to the patio deck and 24 inch to the garage/ parking area from the patio. The front and side walks have been poured in place with the back walk being precast blocks. The lawn has begun to overgrow the back walk at the edges and at the joints.

.3 Deck - There is a 14 x 8 foot patio deck off of the rear door. This deck is approximately 14 inches above grade and has no guards in place. The deck material is almost entirely standard spruce. Stain has worn off in several locations.

.4 Parking - There is a gravelled double parking stall adjacent to the garage off the rear lane and is located outside of the fenced area.
This area is overgrown with weeds in many locations. There is also a lot of debris that has been left here.

.../14

.7 ANCILLARY STRUCTURES (con't):

.5 Garage - 12 x 20 feet in size. Construction is slab on grade with 2 x 4 framing and stucco exterior with asphalt shingles. The garage doors are "home made" with plywood skins. The stucco appears to have a scratch coat only (wire is still visible in some locations) which was then painted over. Shingles are in extremely poor condition with roof sheathing visible in several locations. The floor concrete has cracked severely in a couple of locations. There is also some debris remaining here.

3.0 CONCLUSIONS/RECOMMENDATIONS:

.1 ENERGY CONCERNS - The following components would be considered as being inefficient from an energy standpoint or are sub-standard to todays construction practices (* indicates upgrade considerations):

.1 Doors - Both exterior doors are of poor energy efficient design. In addition to this they have no or ineffective weatherstripping.
* If possible the doors should be replaced or as a minimum they should be weatherstripped.

.2 Windows - As suggested previously in the report, the windows are in poor condition. Several have no storms, others have rot evident in the sashes and/or frames and others have glazing missing.
* Consideration should be given to replacing the windows. This option would likely be less expensive than to rebuild the existing units.

.3 Basement insulation - There is no insulation here at present.
* Attempts should be made to add insulation in this area. This would be relatively simply since the wall areas are all accessible. The only area that may be a concern is the wall adjacent to the stairs which are only an 1½ inches from the wall. The standard practice is to install a dampproofing (from grade down), a 2 x 4 frame wall, R-12 insulation, a vapour barrier and a protection (such as drywall). The insulation and poly should carry into the joist end spaces as well. Other methods will have to be used adjacent to the stairs.

.4 Attic insulation - The present insulation is 3 inches of zonolite (R-7) and R-20 fiberglass batt. With the air films etc. the total present R-value would be 28.5, which is a little below the present standard of 35.7.
* Adding an additional R-8 could be considered. The attic access lid should be insulated. The present insulation will have to be re-installed upon completion of all other work in the attic.

.../15

.5 Exterior walls above grade - As noted above in the report no insulation exists in these areas.

* Again, improvements in this area would have a short payback period. This may also be one of the most challenging areas to upgrade. The final method used would depend to a large extent on other work being undertaken. Choices would be:

: insulated from the interior. This will require drilling numerous holes in the interior finish, blowing in insulation and then repair the interior finish.

Another option would be to remove the interior finish from the exterior walls, install electrical upgrades if these are to be done, provide air sealing were applicable (caulking), install a vapour barrier and a new interior finish. An additional insulation could also be added to the interior of the studs to bring the R-value to present standards.

Insulation could also be added over the interior finish (after blowing insulation into the stud cavities), but this method would not allow for the installation of additional electrical with the same ease; however it would mean not having to remove large areas of painted surfaces containing lead.

: insulate from the exterior. This would mean removing some brick to allow for the drilling of holes in the sheathing. This would mean the wiring would be more difficult to install and that the completed insulation level would be less than the attained with new construction today.

Another method would be to remove all of the brick, complete any electrical upgrades, blow in insulation, install an additional insulation and apply an exterior finish. This would be the most expensive option.

The option including the removal from the interior and upgrading would be the most cost effective while attaining insulation levels to todays standards. This may not have the quickest payback period however.

.6 Air sealing - The present air sealing would be substantially lower than present day requirements.

* Depending on what other work is contemplated the following could be considered:

: provide gaskets (or poly hats) at electrical boxes in insulated areas,

: caulk around windows and doors in exterior walls. Poly wraps can be added to window frames prior to window installation if replacement is to be done,

: caulk along basetrim, preferably behind trim,

: caulk around plumbing lines and electrical wires entering the attic from interior walls or living space

: weatherstrip the attic access

: provide caulking and poly to joist end spaces

.../16

.7 Furnace/Heating - The present furnace appears to be a mid-efficient type, but is still naturally aspirating. The duct distribution system is of poor design and inefficient.

* This furnace could be replaced with one of higher efficiency, but this would likely not be cost effective at this point. It would be well advised to provide a well designed balanced distribution system. Combustion air should also be installed and a humidifier should be considered.

.2 ENVIRONMENTAL CONCERNS: Items mentioned here would be considered as those which could affect the health of the workers at the time of the renovation or later the occupant.

.1 Flooring - Vinyl asbestos tile, although inert while they are in place, can produce an asbestos dust as they are being removed. Older vinyl sheet goods also have some asbestos in the backing and the same concerns would be relevant.

DOES NOT CONTAIN ASBESTOS

.2 Asbestos tape - This type of tape and in some cases the mortar to bind the tape contain asbestos fibers. As with the flooring, in place there is little concern but attention should be given to its removal and disposal.

.3 Exterior ~~slate~~ CEMENT tile - This type of cementitious siding tiles/panels used asbestos fibers as binders. If removal is contemplated it should be done with care as well as with the disposal.

.4 Lead paint - It would have to be assumed that the paint used prior to 1980 contains varying levels of lead. Once the paint has dried, there would be limited concerns, but children chewing on window sills or something similar to this would still carry some risk. Again removal of painted materials can produce air bourne dust particles.

.5 Dust - Dust in general on any construction site would be a concern, and would be particularly so in the case of renovation; this could include mould and fungus growth. Efforts should be made to limit the amount produced, limit the areas that could be affected and stress clean-up procedures. Including in the procedures would be the vacuuming of heating ductwork after completion of construction, vacuuming floors prior to installation of new products, etc.

.6 New Products - The choosing of new materials can add to the level of contamination in the indoor air especially if the air sealing items listed above are undertaken. Many plywoods, including particle boards, and carpets contain urea formaldehyde adhesives. Many paints, caulkings and adhesives give off organic vapours during the curing process.

.../17

.3 OTHER POTENTIAL UPGRADES OR REPAIRS - Some of the suggestions may not be applicable depending on what upgrades are considered.

.1 Closets - the unit has limited closet space and consideration should be given to improving this if possible. The closets in the master bedroom and adjacent to it are deep, but not very wide thereby making the useful space limited. This space would be more usable if it were twice as wide and only half as deep. Clothes closets off of the entries would also be helpful as well as larger linen (or as a minimum new shelves) and a broom closet. A laundry area would also be helped with closet/storage space.

.2 Basement floor - the missing floor area should have concrete installed in them. It would be preferable if the entire floor was removed, have new plumbing lines installed, install a vapour barrier and a new concrete floor complete with all of the gas sealing measures as listed in the NBC (National Building Code). Rot at the base of the columns should be checked while the floor is out.

.3 Ventilation - Each room should have some natural ventilation. This is normally supplied by the windows as is the case now except for the basement. Thought should be given to re-installing the windows in the basement.

In addition to this a ventilation system should be installed which is capable of exchanging all the air in the building ever two hours. This can be done by means of the furnace (intake) and the kitchen/ bathroom fans (exhaust). Or as an alternative a heat recovery ventilator could be used, although at greater expense.

Kitchen and bathroom/s would benefit from the installation of venting fans.

The attic should have some vents installed in it as well.

.4 Electrical - Serious consideration should be given to moving of the electrical panel and making repairs to the present system as well as upgrading it. A smoke detector/s should be installed, the remaining tube and knob portions should be checked, the bath light should be replaced and a GFI receptacle installed, loose wiring should be secured, counter plugs in kitchen should be added and existing rewired, open boxes should be covered, separate circuits supplied for fridge, laundry, furnace etc. and weatherproof plugs added outside, etc.

.5 Water lines - The effective size of the existing water lines would be a quarter of an inch or possibly even less. This results in low water pressure and replacement should be considered especially if additional plumbing fixtures are to be added to the system.

The existing hot water tank would be considered to have exceeded its life expectancy and be replaced as well.

.../18

.6 Exterior finish - The existing finish on the main structure appears to be in good condition. The joints to the front and rear porches would be an on-going maintenance concern both at the walls and the roof because of the poor foundation under these areas. Matching the exterior finish on an addition may be difficult however.

The built out gable ends detract from the appearance of the unit, and removal of them could be reviewed. The joints in this type of finish are not sealed or weather tight either. Repair of damaged tile would also be difficult since they are no longer available and because of the concern with the asbestos.

The completion or replacement of the eavestroughing, downspouts and their extensions should be done. This with positive grade would help to decrease further damage to the foundation.

The removal of the stucco finish from the original brick is not considered viable. The brick is relatively soft and the stucco has adhered well. The replacement of the brick would be very expensive.

.7 Plumbing fixtures - The existing fixtures, such as the shower and the single kitchen sink, would be considered by many as being sub-standard. Their replacement should be reviewed and if replaced consideration should be given to water efficient water closets and shower heads etc.

.8 Front and rear porch - As suggested above in the exterior finish comments, these foundations will result in continued movement of these portions of the structure. If funds permit than the installation of below frost foundations or even their total replacement should be considered.

.9 Garage - The garage is not large but could store an average vehicle. The shingles would have to be replaced as well as the installation of functioning overhead doors to facilitate this storage however.

With the structure having been built on a floating slab, the maintenance of the passage and overhead door would be on-going.

A better alternative would be to close off the garage door, replace the shingles and use the space for storage; or to remove the building entirely.

.10 Miscellaneous repairs

- repaint and install new flooring to suit
- restain the deck off of the back entry
- repair chimney flashing
- ensure grade around the house is positive
- trim back trees to prevent future damage
- the ironing board should be removed from the exterior wall
- repair the kitchen counter top
- repair damaged master bedroom door
- add another ply to the front column supporting the BUBeam in the basement
- the "out of level" of the Basement BUBeam should be checked periodically or levelled

...19

.10 Miscellaneous repairs (con't)

- although no sag was observed in the rafters, in is suggested that they have collar ties installed on them since they are substantially overspanned
- replace clean out cover in basement
- have the vents from the furnace and the hot water tank changed as they enter the chimney. In addition the chimney should be cleaned to remove the soot build-up and lining the chimney should be a good investment.
- the laundry dryer when installed should be vented to the exterior
- consideration should be given to moving the gas meter outside and have the gas line redone
- remove refuse from garage and parking area
- east fence could be improved
- lawn growth should be removed from the rear walk, and increasing the widths of the front and side walks should be considered if they are to be replaced

4.0 **PLANS REVIEW:** Comments are based on plans supplied June 13, 1994 and did not include a work description or specifications. Also the plans supplied contained less information than would normally be expected on a full set of construction drawings. Therefore it is felt that some comments may become redundant or change as additional information is supplied. Comments also assume that all materials and labour are being purchased at market value. (donated materials or labour would change some considerations)

° the brick exterior finish is considered expensive and may not fall into the submitted project objective of being cost effective.
° the railing indicated on the rear deck would not be required by Code assuming the difference in elevation is less than 24 inches -present deck is 14 inches above grade. The intended occupants may benefit from a guard however.
° a brick chimney is indicated on the elevation plans. Real brick would be difficult to support at this point without a full brick chimney.
° the chimney location is not shown on the main floor drawings and may be difficult to incorporate near the furnace location.
° mutton bars are not indicated on all windows??
° submitted project objectives indicate that the house would be wheelchair accessible. The following comments would deal with this topic:
  : no ramp is indicated
  : main floor bath does not appear to be accessible
  : kitchen and bathroom layouts do not allow for a five foot turning radius
  : electrical panel should be on the main floor
  : faucets and door knobs should have paddle type handles
  : plugs and switch heights may change.
° measurements on the "as is" drawings are not the same as those indicated. Will this result in unintended alterations. eg. bath door increased in size.

.../20

4.0 PLANS REVIEW (con't):

- a girder truss is indicated at the location of the removed back wall. The brick veneer can not be supported on this wood member or any other wood surface.
- a column could be installed in the center wall between the kitchen and dining room which would result in a smaller structural member being needed.
- door appears to have been remove from the top of the basement stairs. ABC (Alberta Building Code) requires a door separating the furnace from the livable floor space. The existing door could meet this assuming the bathroom is not installed in the basement.
- need of bathroom in basement is questionable. The rough in for a future bathroom would be advisable since plumbing lines are being installed in this area during renovation.
- the crawl space will need to be insulated, ventilated and have access provided.
- the 10 inch foundation walls are not required by Code.
- an attic access would be required in this area.
- addition attic venting should be installed including roof vents.
- ceiling total R-value should be 35.7. The indicated R-32 may not meet this level.
- poly should comply with CGSB 51-34 standards.

5.0 PHOTOGRAPHS

Page 21 through 23	-	the project committee
Page 24 and 25	-	the project opening ceremonies
Page 25 through 30	-	site, building elevations/exteriors and ancillary structures
Page 31 and 32	-	main floor rooms
Page 35 and 36	-	second floor rooms
Page 37	-	stairwells

6.0 Appendix 'A'

Dave Venhuis
Acting Chief
Technical Resources
CMHC, Edmonton Branch

END

MHC SCHL
Helping to house Canadians

Canada

EXISTING HOUSING INSPECTION REPORT

APPLICANT: Housing Innovation Division - N.O. CMHC ACCOUNT: Reno Demo

PROPERTY ADDRESS: 4725 - 56 Street, Red Deer, Alta. COSTABLE UNIT: 0519

CONTACT: Name: Darrel Smith Phone: 613 - 748 - 2348

AMORTIZATION REQUESTED: 25 years.

NEIGHBOURHOOD

(brief description of immediate area, include any adverse influences)

Older residential area; apartment across lane.

SITE

GRADING: Some negative grading.

DRIVEWAYS/WALKS: Narrow front and side.

GARAGE/CARPORT (attached/detached/services): Single detached - very poor.

APPROXIMATE AGE OF UNIT: 90 years.

EXTERIOR

HOUSE TYPE/DESIGN: Two storey, single family dwelling.

CLADDING (type/condition):

Main floor - stucco. ☐ FAIR ☒ AVG. ☐ GOOD

Upper part of second floor and gable end - asbestos slate.

ROOF (type/condition of cover):

Asphalt shingles. ☐ FAIR ☐ AVG. ☒ GOOD

UNIT INTERIOR

CONDITION OF FINISHED LEVELS ☐ FAIR ☒ AVG. ☐ GOOD

MAIN FLOOR (list rooms and condition of finishes): Living, Dining, Kitchen and entries.

Second floor - 3 bedrooms and bath.

BASEMENT DEVELOPMENT: Nil.

BASEMENT

FOUNDATION (type/condition):

- Poured concrete, minor crack and spalling. ☐ FAIR ☒ AVG. ☐ GOOD

☐ ENGINEER REPORT REQUIRED

MECHANICAL (type/condition):

- Forced air newer, distribution system is poor; vent from HWT enters chimney below furnace vent. ☒ FAIR ☐ AVG. ☐ GOOD

☐ GRAVITY FURNACE

☐ FURNACE INSPECTION REQ'D.

ELECTRICAL (amperage/condition):

100 AMP, some loose wiring and open junction boxes, no smoke alarms. ☐ FAIR ☐ AVG. ☐ GOOD

☒ ELECT. INSPECTION REQ'D.

GENERAL COMMENTS

- Older house with dated fixtures and services. Garage poor and should be considered as storage only.

TECHNICAL OFFICER: (Dave Venhuis) **DATE:** May 30, 1994

CMHC SCHL
Helping to house Canadians

Canada

EXISTING HOUSING INSPECTION REPORT

APPLICANT: Housing Innovation Division **CMHC ACCOUNT:** Reno Demo

PROPERTY ADDRESS: 4725 - 56 Street, Red Deer, Alta.

	MANDATORY REPAIRS REPAIRS LISTED ARE REQUIRED TO ATTAIN REQUESTED AMORTIZATION PERIOD	ESTIMATED COST OF REPAIRS
1	Have electrical checked and repaired by qualified electrician.	$500.00
2	Have hot water tank and chimney vents changed as they enter the brick chimney.	$250.00
3	Install smoke detector(s) as required.	$250.00
	TOTAL COST $	$1,000.00

TECHNICAL OFFICER (Dave Venhuis) **DATE** May 30/94

National Building Inspections

ENGINEERING CONSULTANTS

- Pre-purchase Building Inspection Reports
- Inspection - Roof to Foundation, Mechanical Systems
- Indoor Air Quality Investigations
- Environmental Testing Equipment Rentals
- Home & Office Environmental Surveys

Level I Environmental Audit
4725 - 56 Street
Red Deer, Alberta

• 4632 - 62 Street, Red Deer, Alberta, Canada T4N 6T3 Phone (403) 340-8603 Fax (403) 341-4710
• 76 Country Hill Close N.W., Calgary, Alberta, Canada T3K 3Z2 Phone (403) 295-2914 Fax (403) 295-2914

National Building Inspections

ENGINEERING CONSULTANTS

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June 10, 1994

Red Deer Home Builders Association
201, 7819 - 50 Avenue
Red Deer, Alberta

File No: E-94006

Dear Mr. Boman Husted:

Re: 4725 - 56 Street
Red Deer, Alberta

As requested, we conducted a Level I environmental audit of the subject property on May 26, 1994.

The purpose of this assessment was to provide a general historical review of the property, plus visual observation of the site. Any soil testing, site sampling and laboratory analyses are beyond the scope of this Level I assessment.

- 4632 - 62 Street, Red Deer, Alberta, Canada T4N 6T3 Phone (403) 340-8603 Fax (403) 341-4710
- 76 Country Hill Close N.W., Calgary, Alberta, Canada T3K 3Z2 Phone (403) 295-2914 Fax (403) 295-2914

ENVIRONMENTAL ASSESSMENT REPORT

A) Inspection Data

Property Address: 4725 - 56 Street
Red Deer, Alberta

Legal Description: Lot 11, Block B, Plan K1
Red Deer, Alberta

Property is___Vacant Land_X_Improved

Describe The Property:

The property is consisted of a two storey house with a full basement, a detached garage, and a storage shed. Presently the house is empty. Renovation of the interior and exterior of the house will start soon.

Inspection Date: May 26, 1994

Environmental Inspector: Philip Kwong (P.Eng)

B) Property Description And Analysis

Current Use Of Property _X_ Residential ___ Commercial ___ Industrial ___

___ Undeveloped Land

Past Use Of Property (if known) _X_ Residential ___ Commercial

___ Industrial ___ Undeveloped Land

The following previous and present land title owners were provided by the Alberta Land Title Office.

Land Title: Owner 1.:	Leonard Gaetz	Date: Nov. 1889
Owner 2.:	Augustus Broker & Leonard Gaetz	Date: Nov. 1894
Owner 3.:	Halley Gaetz	Date: June 1901
Owner 4.:	John Wood	Date: Mar. 1904
Owner 5.:	F. Duncan McCrimmon	Date: Apr. 1914
Owner 6.:	Percy Kent	Date: Oct. 1919
Owner 7.:	Cecil Hewson	Date: May 1949
Owner 8.:	Clifford Metcalf & Alice Metcalf	Date: Sep. 1949
Owner 9.:	C. Gardner Craig and Margaret Craig	Date: July 1953
Owner 10.:	William Stange	Date: June 1973
Owner 11.:	Joan Stange	Date: Sep. 1978
Owner 12.:	Jed Wood & Megan Wolfe	Date: Dec. 1978
Owner 13.:	Jed Wood	Date: July 1979
Owner 14.:	Lloyd Mclean	Date: July 1980
Owner 15.:	Margaret Craig	Date: Oct. 1991
Owner 16.:	Douglas Swanson & Helen Elizabeth Swanson	Date: May 1992
Owner 17.:	Patrick Richard Howell	Date: Feb 1993
Owner 18.:	Parkland Community Living	Date: Apr. 1994

C) Interviews & Discussion

The following people were consulted to assist us in evaluating the past and present environmental conditions of this property.

Building Inspection Department

1) On June 6, Mr. Darrel Weber provided us with the following information obtained from the city building inspection department. Two letters were sent to Mr. Lloyd Mclean and one letter to Mr. R. Bartlett.

Letter 1 To Mr. Lloyd Mclean

This letter was sent out on February 6, 1989.

It has been brought to our attention by Northwestern Utilities Limited that a hazardous condition exists at the above mentioned address. The condition, which as follows, is dangerous to the occupants of the building and should be corrected immediately:

Water heater vent connector rusted through.

It is important that this department be notified once the work has been completed, as our records will indicate that the hazardous condition exists until we are otherwise advised. Failure to have the condition corrected, and to advise this department of same will result in the gas being shut off to the gas appliance until the work has been completed. Once we have received notification that this condition has been rectified, we will have the matter removed from our active file, and inspect the site.

Letter 2 to Mr. Lloyd Mclean

This letter was sent out on March 14, 1989.

Should the condition noted below, which could result in serious illness or injury to the occupant(s) of the premises, not be repaired within seven days of the date of this letter and this Department notified of said repairs, we will have no alternative but to order Northwestern Utilities to discontinue the gas service to the noted appliance.

The condition requiring correction is:

Water heater vent connector rusted through.

Your co-operation in this matter would be greatly appreciated.

Letter to Mr. R. Bartlett

This letter was sent out on February 7, 1978.

It has been noted that the Vapour Barrier has not been installed on the warm side of the insulation, in the basement, as required under Subsection 9.26.6 of the Alberta Building Regulations.

Upon completion of the installation of the Vapour Barrier this Department will be called for inspection.

City Public Works Department

1) On May 24, 1994, Mr. Brian Watson of the city solid Waste Superintendent provided us with the following information.

   - In response to your inquiry regarding 4725 - 56 Street, we do not have any records of a garbage disposal site in this area. Our records may not be complete and the earliest information we have dates back to 1965. We cannot say for certain whether or not there was ever a garbage disposal site in this area.

Alberta Environment

1) On May 19, 1994, Mr. Joe Petrie of the Management of Underground Storage Tanks provided us with the following information:

   As per your request, the MUST Project has checked the inventory of both active and abandoned tank sites and there are no records for the property with the following legal land description:

   Legal Land Description: 4725 - 56 Street
   Lot 11, Block B, Plan K1
   Red Deer, Alberta

   Please note that both inventories are not complete. The MUST Project cannot guarantee that tanks do not or have not existed at this location.

2) A request was sent out to the Alberta Environmental Protection Branch regarding any enforcement action that has been taken by their department to the previous land title owners.

On June 3, 1994, Susan Parker of the Alberta Environmental Protection Branch provided us with the following information.

Re: 4725 - 56 Street, Red Deer, Alberta

Pursuant to your letter of June 2, we have searched our records and advise as follows.

There have been no Control Orders, Stop Orders, Prosecutions, or Tickets issued to the above noted company/companies relating to the Hazardous Chemicals Act, Clean Water Act, Clean Air Act, Agricultural Chemicals Act, or the Environmental Protection and Enhancement Act for which the Pollution Control Division of Environmental Protection is responsible.

3) On May 24, 1994, we searched through the latest list of the abandoned industrial landfill sites supplied by the industrial landfill department.

The property described as Lot 11, Block B, Plan K1, Red Deer, does not appear in the latest supplied listing. As indicated, the supplied industrial landfill site list is extensive but not comprehensive of the sites which may be in Alberta.

Fire Department

On May 17, 1994, Mr. Roger Mallett of the Red Deer Fire Inspection Department provided us with the following information:

1) The property is a residential property. There is no record maintained for the property.

Local Historian

On May 30, 1994, Mary Joan Cornett of the Red Deer Museum provided us with the following information:

There was a commercial development operating across the back alley from this property in the 1920's - Russell's Candy Factory. The business was facing on 55th Street but backed on the back alley of the above address.

The house on the south side of 56th Street was believed to have been built for Major Richard Carney Laurie, son of P.G. Laurie, founder of the Saskatchewan Herald, at Battleford, the pioneer newspaper of the North West Territories, when he was district engineer for central Alberta at Red Deer in November 1901. Subsequent to the death of his father in May 1903, he returned to Battleford. In the fall of 1904, the L.R. Baker family, newly arrived from Nova Scotia, occupied it until 1906 when their own new residence was completed. Subsequently, it became the home of George Rothnie, Chief of Police at Red Deer and his family. Chief Rothnie had become acquainted with Baden Powell, founder of the Boy Scouts, and it was as a consequence of a letter to him from Baden Powell, following his decision to extend the Boy Scout organization to Canada, that the first Boy Scout troop in Alberta was formed at Red Deer, and the initial organization meeting was held on the lawn of the then Rothnie home. Subsequently, the house was for many years the home of the Clifford Metcalf family.

Information was gathered from files from the Red Deer Archives, Hendersons directories, and telephone books for the address 4725 - 56 Street. The following is a list of persons who lived at the above address at certain dates. No information was available between 1910 and 1948.

1901 to 1903 - Major Richard Carney Laurie

1904 to 1906 - L.R. Baker

1906 to 1910 - Chief of Police, George Rothnie

1948 - J.A. Carroll - clerk - Lawrence Ltd.

1950 - A. McBeth - labourer for P. Crawford, (wife - Sheila - housewife)

1954 to 1960 - C.L. Metcalf - plasterer - P.T.S., (wife Alice Mary)

1964 to 1965 - C.L. Metcalf - maintenance man - P.T.S., (wife Alice M - nurse - P.T.S.)

1966 to 1972 - Clifford L. Metcalf

1973 to 1975 - William G. Stange

1976 - Roland Hansen

1977 - Robert H. Bartlett

1978 - Anthony B. Dolan

1980 - Robert Askin

1981 to 1982 - No return

1983 to 1984 - Vacant

1985 to 1991 - No return

D) Air Photos

Historical land use of the subject property and adjacent properties based on time lapse aerial photography and available historical information is listed below.

1952

Two buildings on the subject property were noted. The house was in the front and the garage was in the back. There were houses and buildings constructed on four sides of the subject site. Across the back alley from this property and on the south side, there were few buildings scattered around. These could be the Russell's Candy Factory.

1978

The surrounding area was mostly developed. The Russell's Candy Factory was gone and was replaced by the six storey apartment building.

1989 - 1994

A few more apartment buildings were noted on the southwest side of the subject property and along 55 Street.

General Field Observations

1. Subject Property

Current Use: ___Industrial ___Agricultural

___Commercial _X_Residential

Were there any physical signs of the following observed on the property? X for "Yes"

___Underground Storage Tanks	___Storage Buildings
___Above Ground Tanks	___Odor
___Vegetation Damage	___Discarded Batteries
___Oily Sheens On Water	___Oil/Gas Drums
___Streams, Lakes or Ponds	___Lead Paint
___Stained or Discolored Soil	___Asbestos
___Waste Piles	___Other(see comments)

Comments:

The site was covered with mixed vegetation. Vegetation appeared to grow normally. No dead or dying vegetation or irregular bare patches of ground were on the property.

The basement floor was mainly covered with a concrete slab. Along the south end, the subsoil was either exposed or covered with bricks. The air was stuffy. Air humidity appeared to be high. Microbial count is suspected to be high.

2. Adjacent Property

Describe the adjacent sites:

East: **Residential House #4723**

West: **Residential House #4729**

North: **56 Street & Residential House #4722**

South: **Lane and six storey apartment**

Were there any physical signs of the following observed on the subject property? X for "Yes"

___Underground Storage Tanks

___Above ground Tanks

___Vegetation Damage

___Oily Sheens on Water

___Streams, Lakes or Ponds

___Stained or Discolored Soil

___Waste Piles

___Storage Buildings

___Odors

___Discarded Batteries

___Oil\Gas Drums

___Lead Paint

___Asbestos

___Other(see comments)

Comments:

None of the above was observed at the time of our site visit. The surrounding area was occupied by residential houses.

3. Storage Tanks, Storage Rooms or Buildings

Storage Facility

___Yes_X_No : Are buildings or rooms observed within the subject property that may contain or have contained hazardous materials for storage purposes?

___Yes_X_No : Is there any indication that hazardous waste or materials are or have been stored on the property?

4. Underground Storage Tanks(USTS)

___Yes_X_No : Is there any evidence of Underground Storage Tanks on the property?

___Yes_X_No : Is there evidence of soil or groundwater contamination observed on the property?

___Yes_X_No : Are any chemical manufacturing plants, gas stations, petroleum delivery/storage facilities or similar operations observed on surrounding properties?

5. Above Ground Storage Tanks(ASTS)

___Yes_X_No : Are there any Above Ground Storage Tanks on the property?

6. Waste Sites

___Yes_X_No : Is there evidence that the subject property or neighbouring properties have engaged in storing, transporting or producing waste, chemicals or hazardous substances?

7. Water Inspection

Drinking Water

___Yes_X_No : Are water wells, in use or abandoned, on the property?

___Yes_X_No : If yes, are these wells the primary or sole source of drinking water on the property?

_X_Yes___No : Is there evidence of lead or lead soldered pipes observed on the property?

Comments:

The type of service pipe underground could not be verified at the time of our site visit.

8. Drains

___Yes_X_No : Are drains present in work areas of the subject property that could be used for cleaning or flushing machinery or equipment?

_X_Yes___No : Are the drains inside the building of the subject property full?

9. Chemical, Gas & Mineral Inspection

Asbestos

_X_Yes___No : Is there evidence of asbestos on the property?

___Yes_X_No : If any asbestos is observed on the subject property, does it appear friable?

_X_Yes___No : Was the structure constructed before 1979?

_X_Yes___No : Are suspected asbestos containing materials observed, such as sprayed materials on fireproofing areas, pipe insulation, floor tile, etc?

Comments:

The following visible areas were suspected to contain asbestos material. Enclosed areas cannot be examined at time of our inspection.

1. Brown exterior siding.
2. White stucco exterior material.
3. Putty around the window area.
4. Wall insulation material between the back porch doors.
5. Floor tile from the stairs to the second floor.
6. White duct tape in the return air duct.
7. Floor tile under the carpet in the back porch.

10. Urea Formaldehyde Foam Insulation(UFFI)

___Yes_X_No : Is there evidence of Formaldehyde Foam Insulation on the property?

11. Lead Paint

_X_Yes___No : Is there visible evidence of peeling, cracking or flaking paint?

_X_Yes___No : Is there evidence suggesting the possibility of lead paint on the ceilings, walls or floors of any structures on the property?

Comments:

The following visible areas were suspected of containing lead paint:

1. Front entrance door jam - east side.
2. Lower stair guard - east face.
3. Upper floor wall - southwest room.
4. Window rail north wall - north east from the main floor.
5. Upper floor ceiling.
6. Main floor northeast room - south wall.
7. Kitchen floor base board.
8. Kitchen ceiling.

12. Pesticides/Herbicides

___Yes_X_No : Does it appear that pesticides or herbicides have been stored or used in excess of normal use within the subject property ?

___Yes_X_No : Is the property used for agricultural purposes?

___Yes_X_No : Has the property been used for agricultural purposes in the past(10) years?

___Yes_X_No : Are there any noticeable pesticide odours?

___Yes_X_No : Are there noticeable signs of straining or stressed vegetation?

13.Fibreglass

_X_Yes___No : Is Fibreglass observed as an insulator or for any other purpose?

_X_Yes___No : Is Fibreglass observed on any surface that appears worn, where individual fibres are exposed in a condition where release into the air likely?

Comments:

1. Pink fibre glass insulation is in the attic area which is enclosed.
2. The black fresh air supply plastic duct has yellowish fibreglass exposed. It should be replaced with a properly insulated metal duct.

14.Polychlorinated Biphenyl(PCB's)

___Yes_X_No : Are any transformers, electrical devices or hydraulic equipment observed on the property labelled as containing PCB's?

___Yes_X_No : Is there evidence of oil leakage from any machinery of devices that may contain PCB's?

___Yes_X_No : Is there evidence of PCB contamination to the soil or groundwater observed on the property?

___Yes_X_No : Are fluorescent light ballasts labelled as containing PCB's Observed?

15. Radon

___Yes_X_No : Is there reason to suspect that radon may be a problem in the immediate property's location?

___Yes_X_No : Has radon screening been conducted which indicates that the property may have elevated levels of radon?

General

___Yes_X_No : Are there any conditions present not previously mentioned that need to be evaluated for any potential environmental risk?

___Yes_X_No : Are there any activities of adjacent properties that may pose potential environment risks to the subject property?

___Yes_X_No : Are the conditions of subsoil and groundwater within the subject properties known.

Summary & Conclusion Of Inspection

Suggest Level II Environmental Audit _X_ Yes ___ No

___Underground Storage Tanks	___Urea Formaldehyde Foam Insulation
___Above Ground Storage Tanks	_X_Lead Paint
___Waste Sites	___Pesticides/Herbicides
___Drinking Water	___Polychlorinated Biphenyl(PCB's)
_X_Asbestos	_X_Radon
	_X_Other(see comments)

Comments:

Lead content in water and microbial contamination analyses.

Based on currently available information as of the inspection date, I believe to the best of knowledge that the facts and data used in these inspections are true and accurate. I personally examined the subject property. I have no undisclosed interest, present or future in the subject property.

Addendum (certificate, limiting conditions and air photos) are attached and are made a part of this report.

Yours truly,
National Building Inspections

Philip Kwong

Philip Kwong (P.Eng)

CERTIFICATION

AND

STATEMENT OF LIMITING CONDITIONS

Certification : The environmental inspector certifies to the buyer, seller and/or lender in a transaction as named in the inspection report"Principal Parties"; and the inspector and the principal parties agree that:

1. The environmental Inspector has no present or contemplated future (a) partnership with Principal Parties nor (b) an interest in the property inspected which could adversely affect the Inspector's ability to perform an objective inspection; and neither the employment of the inspector to conduct the inspection, nor the compensation for it, is contingent on the results of the inspection.

2. The environmental inspector has no personal interest in or bias with respect to the subject matter of the inspection report or any parties who may be part of a financial transaction involving the property. The conclusions and recommendations of the report are not based in whole or in part upon the race, color,creed,sex or national origin of any of the principal parties.

3. The environmental inspector has personally inspected the property, both inside and out and has made visual inspection of adjacent properties to the extent possible by readily available access. The inspection does not include the removal of any soil water or air samples, the moving of furniture or fixtures, or any type of inspection that would require extraordinary effort to access.

4. All contingent and limiting conditions are contained herein(imposed by the terms of the inspection assignment or by the undersigned affecting the conclusions and recommendations contained in the report).

5. All opinion, conclusions and recommendations concerning the inspected property that are set forth in the inspection report were prepared by the environmental inspector whose signature appears on the report. No change of any item in the report shall be made by anyone other than the inspector,and the inspector shall have no responsibility for any such unauthorized change.

Contingent and Limiting Conditions : The certification of the environmental inspector appearing in the environmental inspection report is subject to the following conditions and to such other specific and limiting conditions as are set forth by the inspector in the report.

1. The inspector assumes no responsibility for matters of a legal nature affecting the property inspected or the title thereto. The property is inspected assuming responsible ownership.

2. Any sketch appearing in or attached to the inspection report, or any statement of dimensions, capacities, quantities or distances, are approximate and are included to assist the reader in visualizing the property . the inspector has made no survey of the property.

3. The inspector is not required to give testimony or appear in court because of having made the inspection with references to the property in question, unless arrangements have been previously made therefor.

4. This report is not intended to have any direct effect on the value of the property inspected but simply to provide a visual environmental assessment solely for the benefit of the principal parties.

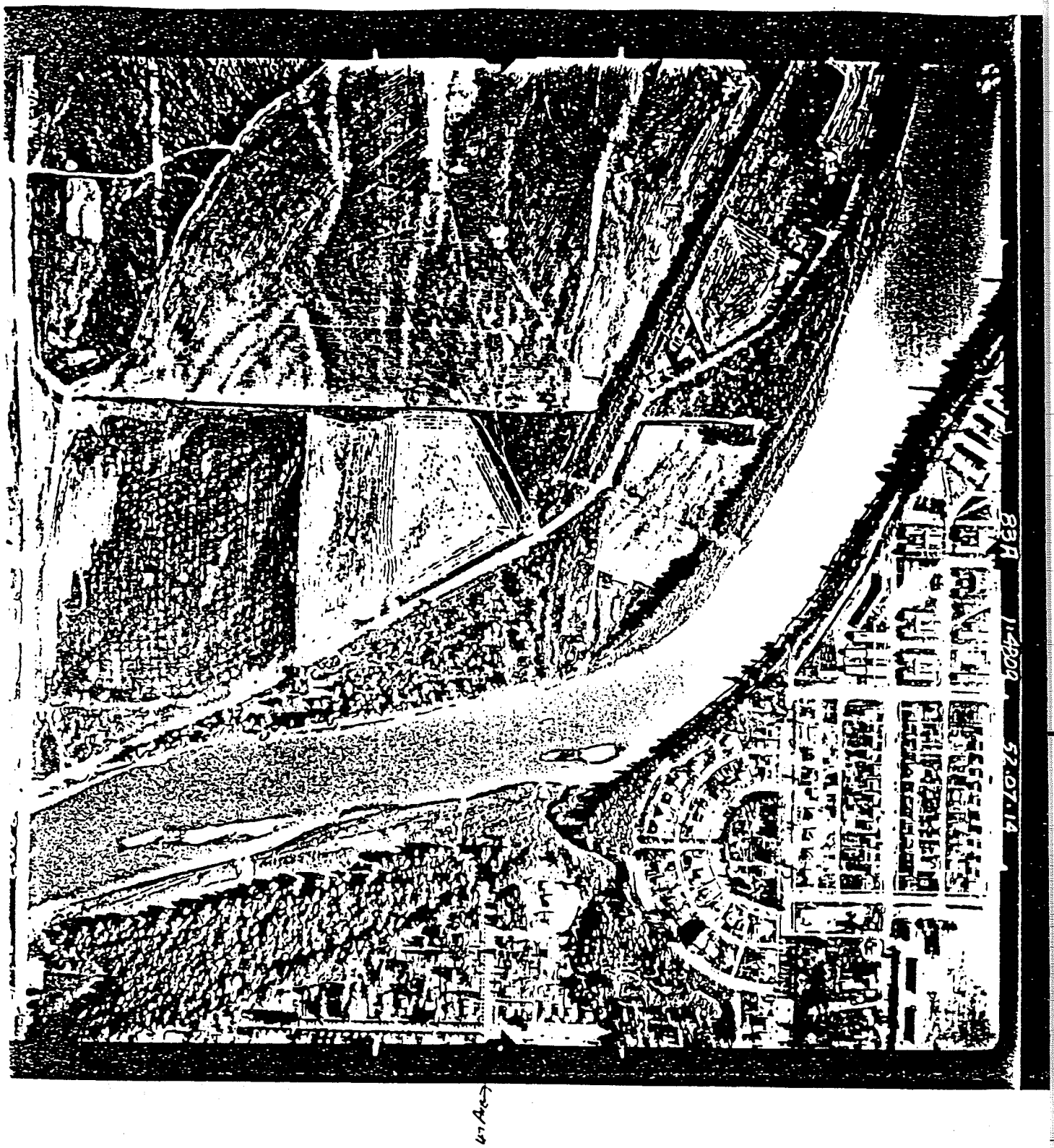
5. The inspector assumes that there are no hidden, unapparent,or latent conditions or defects in or of the property,subsoil or structures,other than those noted on the inspection report or any addendum to the report which the inspector had included. The inspector assumes no responsibility for such conditions, or for the inspection, engineering or repair which might be required to discover or correct such factors.

6. Information,estimates and opinions furnished to the inspector, and contained in the report,were obtained from sources considered reliable and believed to be true and correct. However, the inspector had made no independent, investigation as to such matters and undertakes no responsibility for the accuracy of such items.

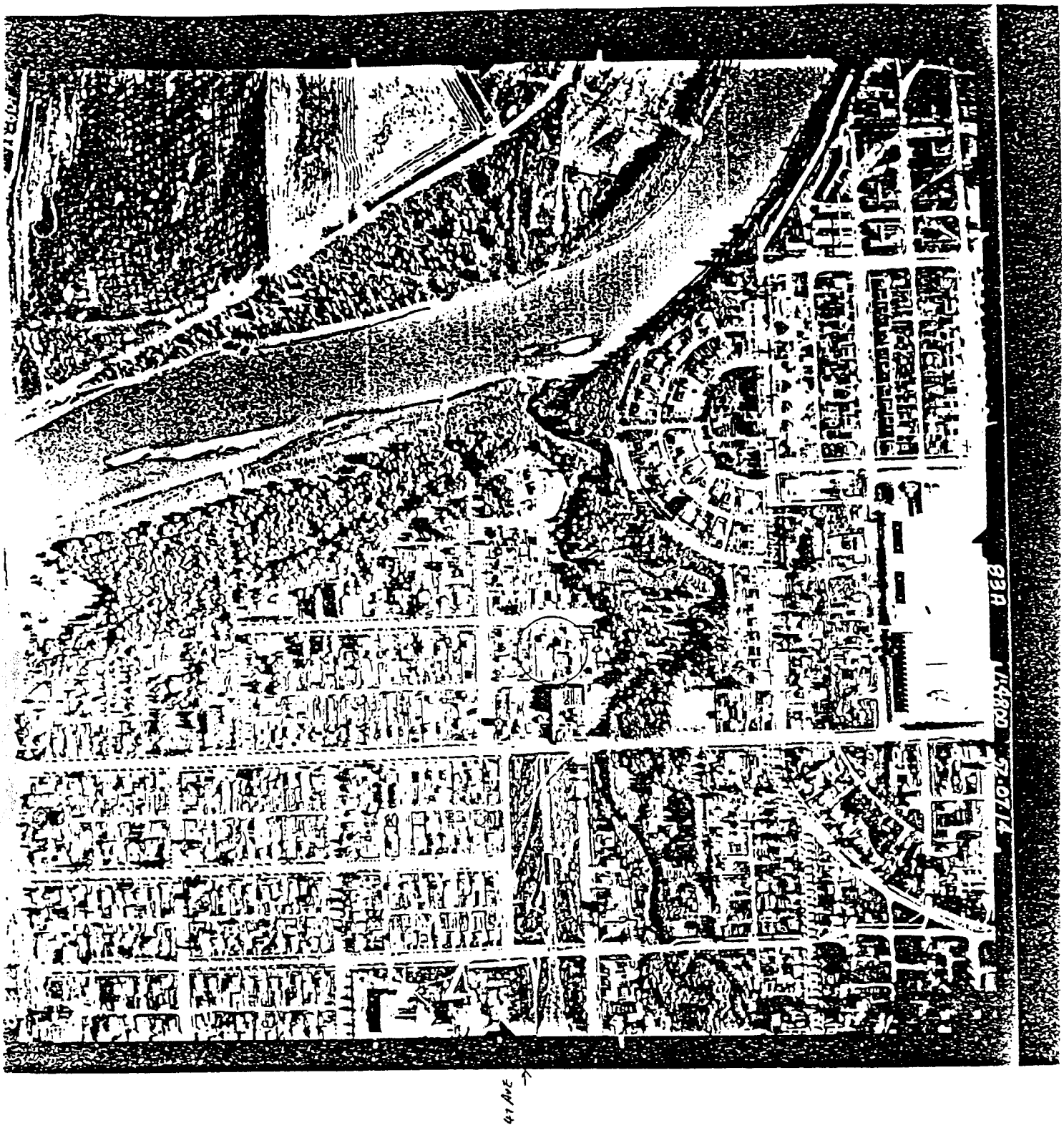
7. The inspection and inspection report are made by the inspector solely for the benefit and personal use of the principal parties. No disclosure may be made of the inspecton report without the prior written consent of the inspector and the inspector undertakes no responsibility for harm or damages to any party other than the principal parties.

4725-56 STREET(RED DEER,ALBERTA)

Aerial photograph of Red Deer showing location of house, 1.



Aerial photograph of Red Deer showing location of house, 2.



Aerial photograph of Red Deer showing location of house, 3.

APPENDIX B

Level 2 Environmental Audit

National Building Inspections

ENGINEERING CONSULTANTS

- Pre-purchase Building Inspection Reports
- Inspection - Roof to Foundation, Mechanical Systems
- Indoor Air Quality Investigations
- Environmental Testing Equipment Rentals
- Home & Office Environmental Surveys

Level II Environmental Audit
4725 - 56 Street
Red Deer, Alberta

• 4632 - 62 Street, Red Deer, Alberta, Canada T4N 6T3 Phone (403) 340-8603 Fax (403) 341-4710
• 76 Country Hill Close N.W., Calgary, Alberta, Canada T3K 3Z2 Phone (403) 295-2914 Fax (403) 295-2914

National Building Inspections

ENGINEERING CONSULTANTS

- Pre-purchase Building Inspection Reports
- Inspection - Roof to Foundation, Mechanical Systems
- Indoor Air Quality Investigations
- Environmental Testing Equipment Rentals
- Home & Office Environmental Surveys

June 13, 1994

Red Deer Home Builders Association
201, 7819 - 50 Avenue
Red Deer, Alberta

Dear Mr. Boman Husted:

Re: 4725 - 56 Street
Red Deer, Alberta

As informed by Mr. Don Fugler of Canada Mortgage and Housing Corporation, only the following tests are required in the Level II Environmental Audit.

1) Asbestos

Collect samples only where asbestos containing material (ACM) is friable or in poor condition, or in areas that are likely to be disturbed by the renovation activities. If there is suspected ACM in an area unlikely to be disturbed, and it is good condition, testing is not required.

2) Lead Paint

Only in areas that are likely to be disturbed by the renovation activities. Any areas that are unlikely to be disturbed, testing is not required.

3) Indoor Mold Testing

Mold testing should be deferred until winter when outdoor mold concentrations are negligible. There should be no pre-renovation testing for mold.

4) Radon Testing

Only one week of Electret test will be required.

Yours truly,
National Building Inspections

Philip Kwong

Philip Kwong (P.Eng)

• 4632 - 62 Street, Red Deer, Alberta, Canada T4N 6T3 Phone (403) 340-8603 Fax (403) 341-4710
• 76 Country Hill Close N.W., Calgary, Alberta, Canada T3K 3Z2 Phone (403) 295-2914 Fax (403) 295-2914

National Building Inspections

ENGINEERING CONSULTANTS

- Pre-purchase Building Inspection Reports
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June 10, 1994

Red Deer Home Builders Association
201, 7819 - 50 Avenue
Red Deer, Alberta

Dear Mr. Boman Husted

Re: 4725 - 56 Street
Red Deer, Alberta

For your information, the suspected asbestos containing material in the exposed area is sampled at the following locations. Its concentration (%) and type are also included.

Location	Type	Concentration(%)
Floor tile from stairs to 2nd floor	none	none
Brown exterior siding	chrysotile	20
White tape in basement return air duct	chrysotile	70
Putty around glass windows	chrysotile	trace
White stucco exterior	none	none
Floor tile under carpet in back porch	none	none
Wall insulation between back porch of house	none	none

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Phone (403) 340-8603 Fax (403) 341-4710
Phone (403) 295-2914 Fax (403) 295-2914

1. The health risks due to the presence of Chrysotile, Amosite or Crocidolite asbestos are dependent on several factors including:

   its friability - does the material crumble easily?
   its condition - has the material begun to break down or deteriorate?
   its location - accessibility to people or exposure to air currents.

2. No "safe level" for asbestos can be recommended, as there is no apparent threshold for asbestos related carcinogenicity. Exposure therefore should be kept as low as possible.

3. During home renovations and installation procedures, precautions should be taken to minimize the inhalation of and skin contact with asbestos and man made mineral fibres (MMMF). In addition, materials and products containing asbestos should be examined periodically for signs of deterioration. Before removing or damaging any materials thought to contain asbestos, information and advice should be sought from government agencies.

Yours truly,
National Building Inspections

Philip Kwong

Philip Kwong (P.Eng)

National Building Inspections

ENGINEERING CONSULTANTS

- Pre-purchase Building Inspection Reports
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June 10, 1994

Red Deer Home Builders Association
201, 7819 - 50 Avenue
Red Deer, Alberta

Dear Mr. Boman Husted:

Re: 4725 - 56 Street
Red Deer, Alberta

For your information, the lead concentration of the water collected at the following location is as follows:

Location	Concentration (Mg/L)
Kitchen sink in main floor	0.003

Based on the fifth edition of the Guidelines for Canadian Drinking Water Quality, the maximum acceptable lead concentration in drinking water is 0.01 Mg/L.

Because lead is a component of many plumbing systems, first drawn water may contain higher concentrations of lead than are found in running water after flushing. Faucets should therefore be thoroughly flushed before water is taken for consumption or analysis.

Yours truly,
National Building Inspections

Philip Kwong

Philip Kwong (P.Eng)

- 4632 - 62 Street, Red Deer, Alberta, Canada T4N 6T3 — Phone (403) 340-8603 Fax (403) 341-4710
- 76 Country Hill Close N.W., Calgary, Alberta, Canada T3K 3Z2 — Phone (403) 295-2914 Fax (403) 295-2914

National Building Inspections

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June 10, 1994

Red Deer Home Builders Association
201, 7819 - 50 Avenue
Red Deer, Alberta

Dear Mr. Boman Husted:

Re: 4725 - 56 Street
Red Deer, Alberta

For your information, the results of the lead in paint were as follows.

Location	Concentration of lead (mg/cm2)
Front entrance door jam - E side	7.8
Lower stair guard E face	0.011
Upper floor wall - SW room	0.004
Window rail N wall - NE room main floor	0.006
Upper floor ceiling	0.01
Main floor - NE room S wall	0.0004
Kitchen floor base board	0.15
Kitchen ceiling	0.22
Water pipe upper floor bath room	0.60
Kitchen cupboard surface	0.001
Inner surface garage door	0.90
Window by front porch	12.80

It is not possible to derive an acceptable "air lead level" for the indoor environment as there is uncertainty in determining total exposure to lead of airborne origin that has settled in household dust. Therefore, it is recommended that surfaces that may be contaminated with lead be cleaned frequently, and that a high standard of overall cleanliness be maintained in order to minimize the exposure of people, especially children, to lead of airborne origin.

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During home renovations and installation procedures, precautions should be taken to minimize the inhalation and ingestion of lead fumes and lead dust. The ingestion of lead laden dust is a major pathway for lead exposure. Before removing or damaging any paint materials thought to contain lead, information and advice should be sought from government agencies.

Yours truly,
National Building Inspections

Philip Kwong

Philip Kwong (P.Eng)

National Building Inspections

ENGINEERING CONSULTANTS

- Pre-purchase Building Inspection Reports
- Inspection - Roof to Foundation, Mechanical Systems
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- Environmental Testing Equipment Rentals
- Home & Office Environmental Surveys

REPORT OF RADON MEASUREMENT

Name of Person Requesting Measurement: Mr. Boman Husted

Address of House Measured: 4725 - 56 Street
Red Deer, Alberta

Type of Measurement: (Screening)

Name(s) of Person(s) taking measurement: Tina Empey

Location of monitor installed: 2.5m W & 3.5m S of NE corner in the basement. 1.3m off ground.

Radon Monitor ID No. SC1487

Start Time: 5:40 pm Date: May 25, 1994

Stop Time: 1:00 pm Date: June 2, 1994

The radon measurement identified above gave an average radon concentration of 8 Bq/m^3 when the basement was depressurized to about 2.5 Pascal.

This analysis represents the average radon^{222} concentration in the air only during the measurement period indicated.

Radon guidelines for indoor air is based on:

The Federal Provincial Advisory Committee on Environmental and Occupational Health.

800 Bq/m^3 - Action Level

- If the action level is exceeded, remedial measures should occur within a 12 month period.

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If you have further questions, please call 340-8603.

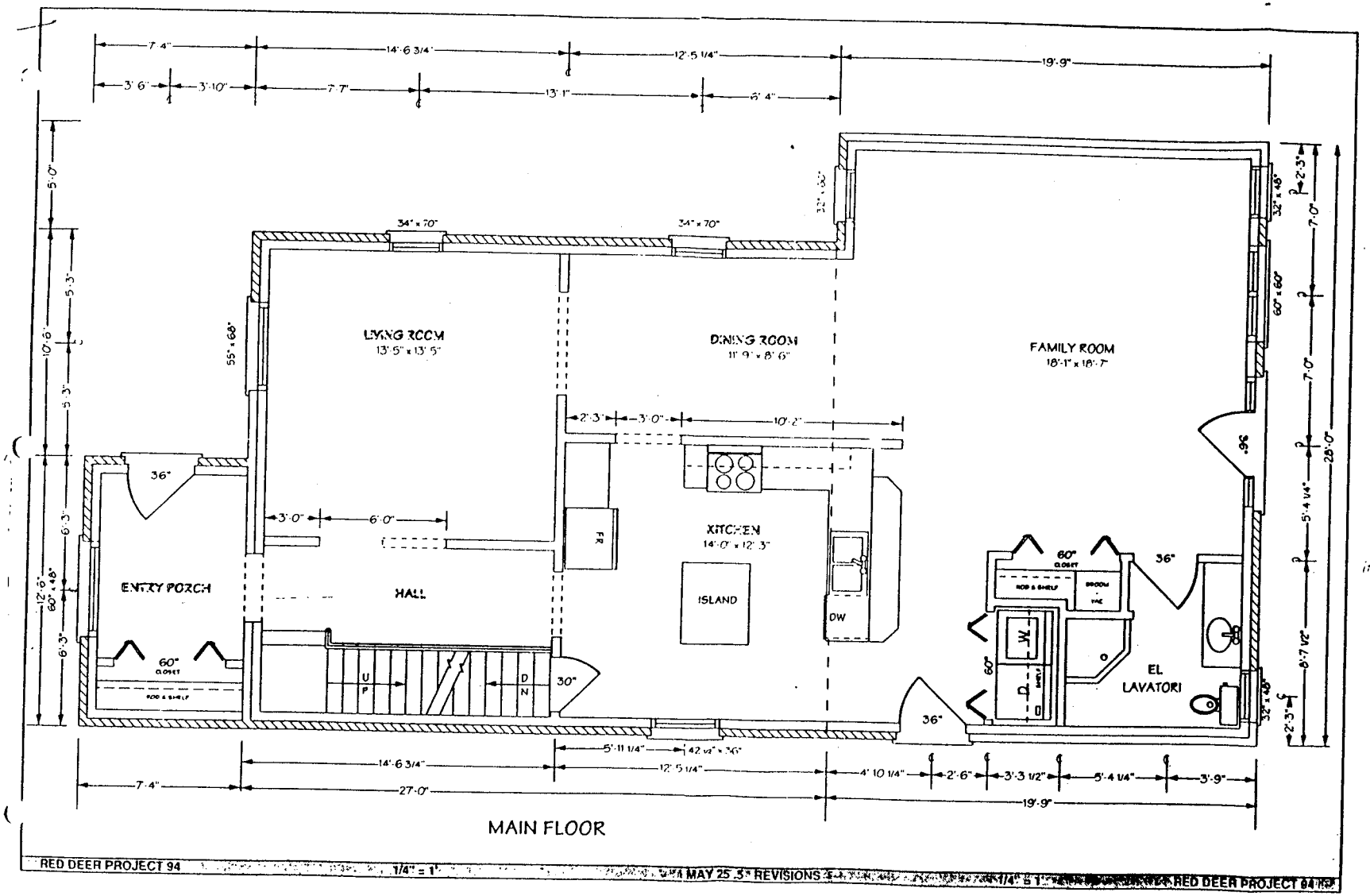
Yours truly,
National Building Inspections

Philip Kwong

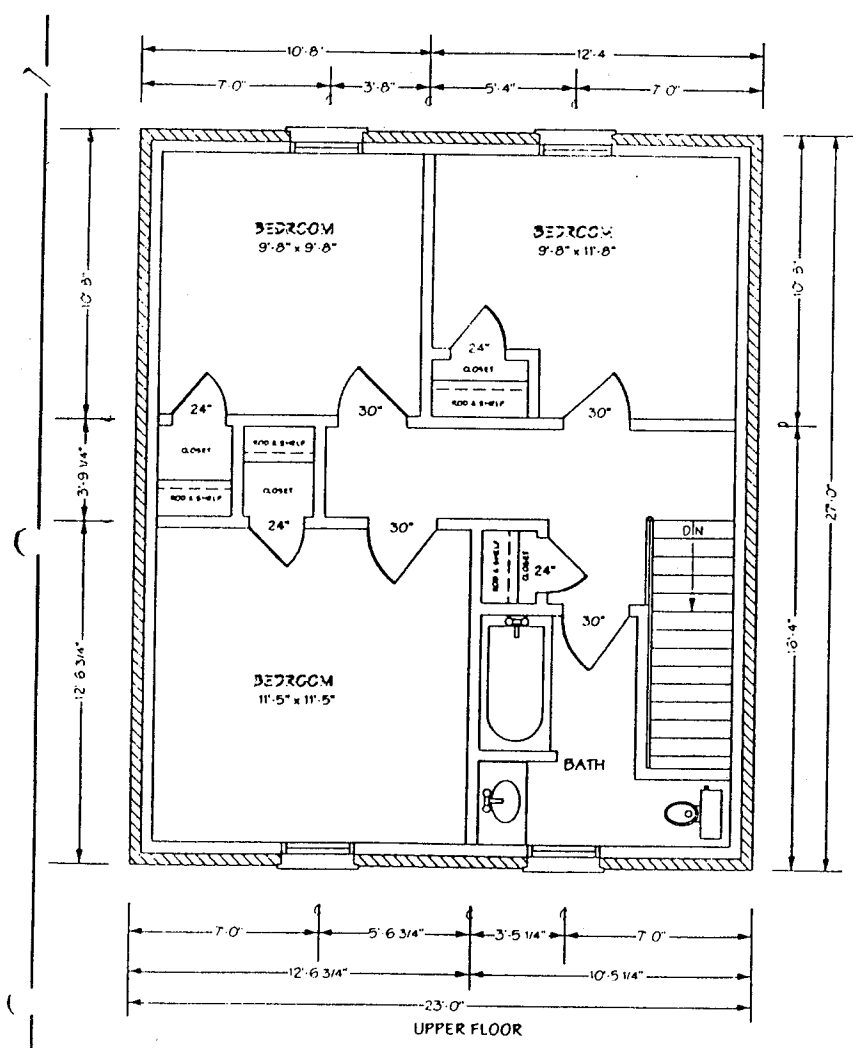
Philip Kwong (P.Eng)

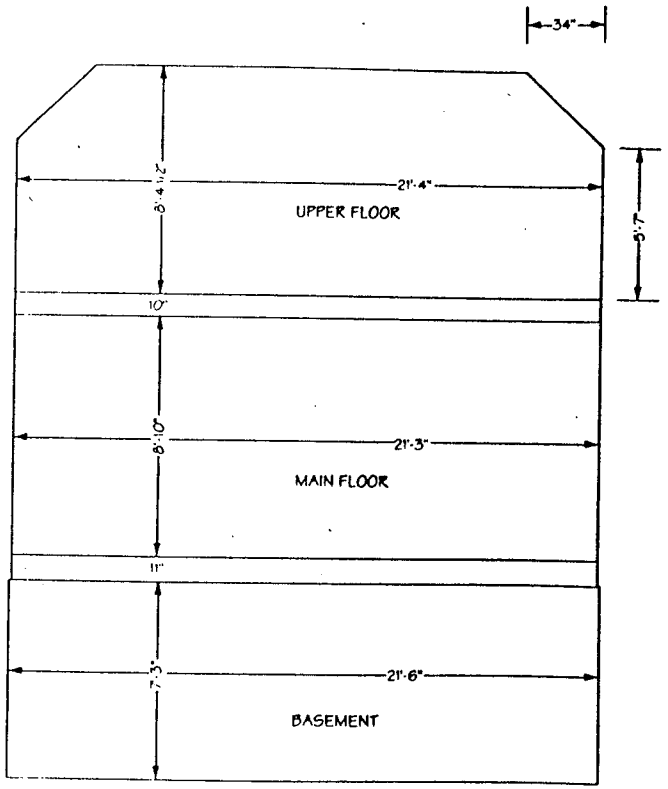
APPENDIX C

Documentation of HOT2000 Computer Analysis



RED DEER PROJECT 94 1/4" = 1' MAY 25 '.3* REVISIONS 1/4" = 1' RED DEER PROJECT 94





EXISTING CROSS SECTION - INTERIOR DIMENSIONS

RED DEER PROJECT 94 1/4" = 1'

MAY 25.5 REVISIONS

1/4" = 1' RED DEER PROJECT 94

WINDOWS

					H	HA bov	OH
N.	PORCH	$5^{0} \times 4^{0}$	TRI.	M1	4^{0}	0^{9}	1^{0}
	MAIN	$4^{9} \times 5^{8}$	SNGL.	M3.	5^{8}	0^{6}	8^{4}
	ADD^{N}	$2^{8} \times 5^{0}$	TRI.	M3.	5^{0}	0^{6}	1^{0}
	2ND	$2 \times 2^{6} \times 4^{6}$	SNGL	M6.	4^{6}	5^{6}	1^{0}
E.	MAIN	$2 \times 2^{8} \times 5^{10}$	SNGLE	M3.	5^{10}	7^{4}	1^{0}
W.	MAIN	$2^{8} \times 5^{10}$	SNGLE	M3	5^{10}	7^{4}	1^{0}
S	ADD^{N}	$5^{0} \times 5^{0}$	TRI	M1.	5^{0}	2^{0}	1^{0}
		$2\ 2^{8} \times 4^{0}$	TRI	M1	4^{0}	2^{0}	1^{0}
		$2 \times 1^{2} \times 6^{6}$	TRI	M1	6^{6}	2^{0}	1^{0}
	2ND	$2 \times 2^{0} \times 4^{6}$	SNGL	M5	4^{6}	5^{6}	1^{0}
	ADD	$2^{4} \times 5^{6}$	TRI	D3.	5^{6}	6^{3}	1^{0}

DOORS

PORCH	$3^{0} \times 6^{6} - 19.5$	R12	D1	M1	
ADD^{N}	$3^{0} \times 6^{6} - 19.5$	R12	D2	M2.	
	$3^{0} \times 6^{6} - 19.5$	R12.	D3	M2	PATIO DOOR

BASEMENT CALC.

BASEMENT VOLUME

FRONT PORCH (CRAWLSP)

$(6'-8\frac{1}{2}+10'') \times 11'-3'' \times (4\frac{4}{4}+11'')$ 445.92

MAIN HOUSE (87" BSMT)

$25'-2'' \times 10^{6} \times (87''+11'')$ 2159.2

$25'-6'' \times 10^{4} \times (87''+11'')$ 2152.1

BACK ADDITION (CRAWLSP)

$17'-5'' \times 5'-0'' \times (4\frac{4}{4}+11'')$ 457.3

$17'-9'' \times 21'-0'' \times (4\frac{4}{4}+11'')$ 1956.94

6725.54 ✓

SLAB TOTAL

$6^{8\frac{1}{2}} \times 11^{3}$

$0^{10} \times 11^{3}$

$25^{2} \times 10^{8}$

$25^{2} \times 10^{2}$

$0^{10} \times 20^{10}$

$17^{9} \times 21^{0}$

$17^{5} \times 5^{0}$ = 1086.8

PERIM. 3^{3}

$11^{3} \times 3^{3}$

$(6^{8\frac{1}{2}}+0^{10}+0^{4}) 3^{3}$

$10^{2} \times 3^{3} + (25^{2}+0^{10}+0^{4}) \times 3^{3}$

$5^{0} \times 3^{3} + (17^{5}-3^{3}) \times 3^{3} + (26^{0}-3^{3}) 3^{3}$

$+(17^{9}+0^{10}+25^{2}+0^{10}+6^{8\frac{1}{2}}-3^{3}) \times 3^{3}$

= 472.9 ✓ R0

CR AREA. 613.9 ✓ R0

HIDDEN AREA

$(6^{8\frac{1}{2}}+0^{10}+10^{2}+25^{2}+0^{10}+5^{0}+17^{5}+26^{0}+17^{9}+0^{10}+25^{2}+0^{10}+6^{8\frac{1}{2}}+11^{3}) 0^{11}$ USE R.20 112.33 ✓

AB GR

$(2 \times 6^{8\frac{1}{2}}+11^{3}) 1^{0}$	24.67	R20	R20	24.67 ✓
$(10^{2}+25^{2}+20^{10}) 1^{0}$	56.10	R12	R12	72.35 ✓
$2 \times 0^{10} \times 1^{0}$	1.68	R0	R0	1.68 ✓
$(5^{0}+17^{5}+26^{0}+17^{9}) 1^{0}$	66.17	R12		

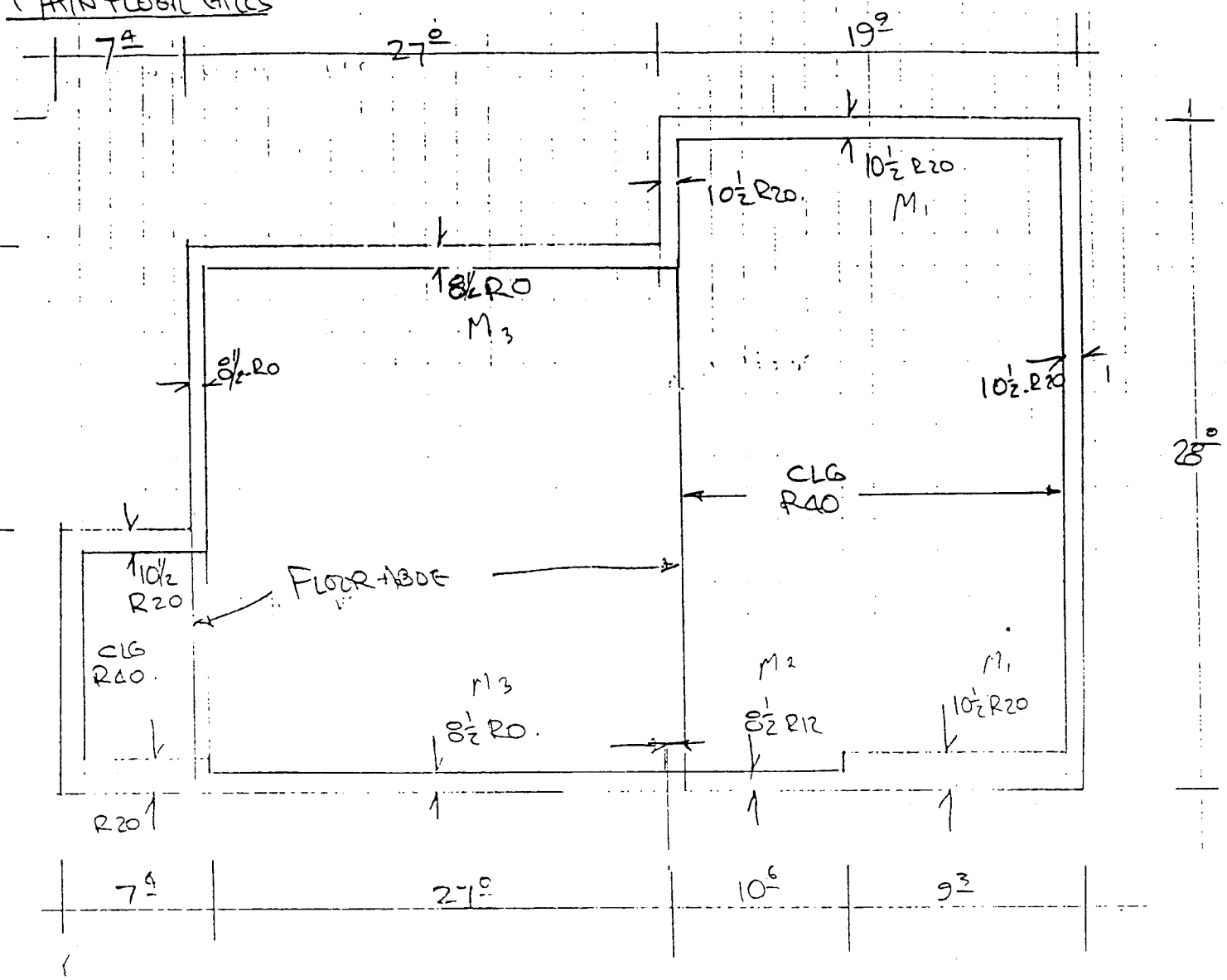
GR → 24"

$(2 \times 6^{8\frac{1}{2}}+11^{3}) 2^{0}$	22.50	R20	R20	22.50 ✓
$(10^{2}+25^{2}+20^{10}) 2^{0}$	112.36	R12	R12	200.66 ✓
$2 \times 0^{10} \times 2^{0}$	3.36	R0	R0	3.36 ✓
$(5^{0}+17^{5}+26^{0}+17^{2}) 2^{0}$	132.30	R12		

24" → SLAB

$(2 \times 6^{8\frac{1}{2}}+11^{3}) 1^{4}$	32.81	R20	R20	32.81 ✓
$(10^{2}+25^{2}+20^{10}) 4^{3}$	238.77	R12	R12	519.99 ✓
$2 \times 0^{10} \times 2^{0}$	3.36	R0	R0	97.06 ✓
$(5^{0}+17^{5}+26^{0}+17^{2}) 4^{3}$	281.22	R12		
$(2^{11} \times 11^{3})$	32.85	R0		
$(2^{11} \times 20^{10})$	60.85	R0		

MAIN FLOOR CALCS



M1 R20 × 10½ $(6^{5\frac{1}{2}} + 10^{9} + 6^{5\frac{1}{2}})\,8^{10}$ 209.24.
$(4^{1\frac{1}{2}} + 18^{0} + 26^{3} + 8^{4\frac{1}{2}})\,8^{10}$ 501.58
710.82 ✓

CLG. R40 $18^{0} \times 26^{9} + (9^{6\frac{1}{2}} \times 0^{2})$ $11^{3} \times 5^{7}$ } 545.90 ✓

M1,2 R12 × 8½ $10^{6} \times 8^{10}$ 92.82 ✓

M3 RO × 8½ $(27^{0} + 26^{1\frac{1}{2}} + 9^{6\frac{1}{2}})\,8^{10}$ 553.91 ✓

HDR AREA FLOOR ABOVE

$(9^{9\frac{1}{2}} + 26^{9\frac{1}{2}} + 27^{10\frac{1}{2}})\,0^{10}$ = 50.15 ✓ RO

VOLUME

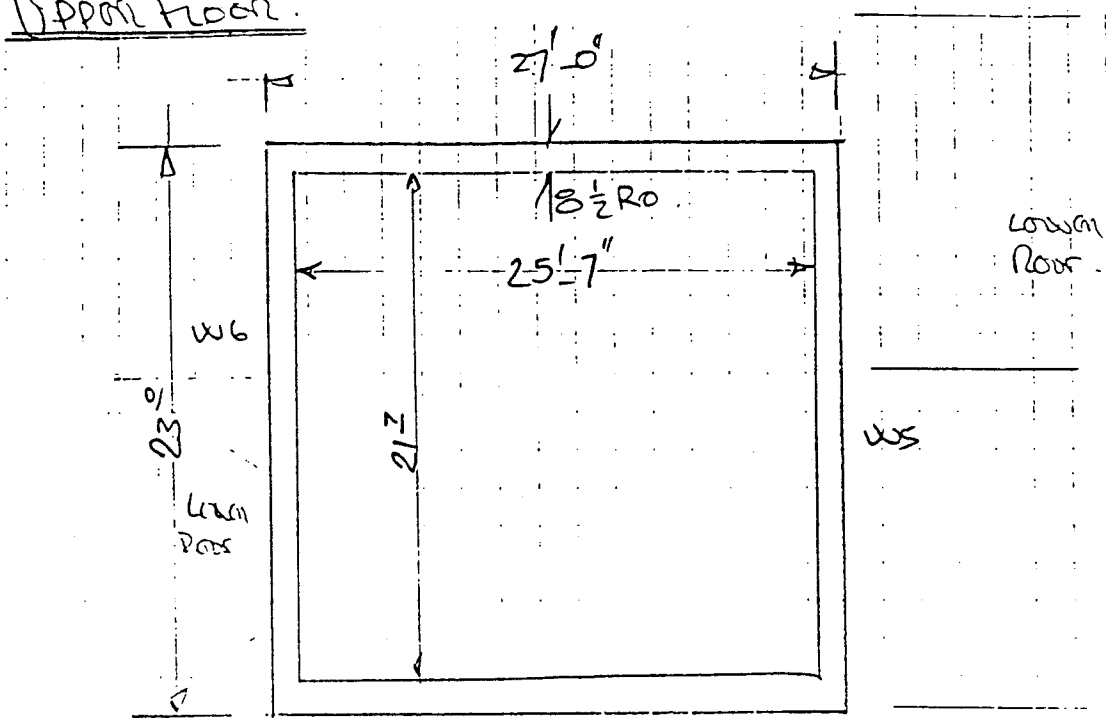
10067.84 ✓ 489.43

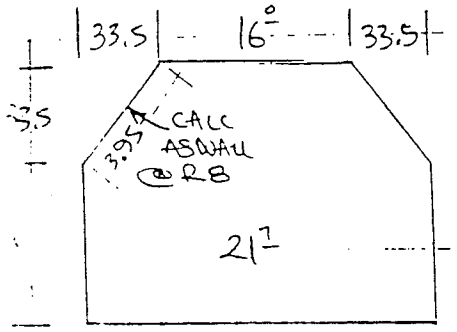
10557.27

$8^{10}\left[(10^{9} \times 6^{5\frac{1}{2}}) + (27^{2} \times 21^{7}) + (18^{0} \times 26^{9}) + (9^{6\frac{1}{2}} \times 0^{2})\right]$ } SPACE.

$(27^{0} \times 21^{7})\,0^{10}$ ← FLOOR

Upper Floor.





M4	2×5'-7"×25'-7"	285.47 RO	
M7	2×3.95×25'-7"	202.08 RO	
M5	8 4½ × 21'-7" − 2 9½ × 2 9½	172.84 RO	
M6	8 4½ × 21'-7" − 2 9½ × 2 9½	172.84 RO	

CLG AREA 16'-0" × 25'-7" 409.28. R.24 6" FF BATTS + 2×03" @ ON CENTRE

VOLUME = 172.84 × 25'-7"
= 4421.25.

```
*****************************************
*                                       *
*              Hot2000                  *
*            Version 6.02               *
*              CANMET                   *
*  Energy, Mines and Resources CANADA   *
*            July 1, 1991               *
*                                       *
*****************************************
```

House Data Filename=ROOT:H2k:RENODE-A.HDF

Weather Data is for ROCKY MOUNTAIN HOUSE, ALBERTA

Builder Code =RDHBA Data Entry by:Jim Marke

Client name: RED DEER PROJECT 94
Street address: 4725-56 Street
City: Red Deer Region:
Postal code: Telephone: 346 5321

*** GENERAL HOUSE CHARACTERISTICS ***

House type: Single detached
Number of storeys: Two storeys
Wall construction: Single stud wall

SOIL TYPE: Normal Conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 0.5 in. gyproc walls and ceiling, wooden floor

Occupants : 2 Adults for 50.0 % of the time
1 Children for 50.0 % of the time

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 68.0 F
	TEMP. Swing from 69.8 F	= 6.3 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement
Full Basement	None	Interior

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Location Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC
South	1	M1	1	320222	5.000	5.000	1.000	2.000	.5313

	2	M2	2	320222	2.670	4.000	1.000	2.000	.4745
	3	M3	2	320202	1.000	6.500	1.000	2.000	.4848
	4	M5	2	100022	2.500	4.000	1.000	5.500	.6099
	5	D3	1	320202	2.330	5.500	1.000	6.250	.5718
East	1	M3	2	100022	2.670	5.840	1.000	7.330	.6590
North	1	M1	1	320222	5.000	4.000	1.000	.750	.5210
	2	M3	1	100022	4.750	5.670	8.330	.500	.7011
	3	M3	1	320222	2.670	5.000	1.000	.500	.4953
	4	M6	2	100022	2.500	4.500	1.000	5.500	.6248
West	1	M3	1	100022	2.670	5.840	1.000	7.330	.6590

***** WINDOW PARAMETER CODES SCHEDULE *****

Code		Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1	320222	Triple (TG), Low-E .2 (Hard1), 13 mm Air, Insulating, Slider with sash, Wood
2	320202	Triple (TG), Low-E .2 (Hard1), 13 mm Air, Insulating, Picture, Wood
3	100022	Single (SG), Clear, 13 mm Air, Metal, Slider with sash, Wood

***** BUILDING PARAMETERS *****

Component		Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Love Grade Components						
Ceiling						
C1		545.90	545.90	40.00		
C2		409.28	409.28	24.00		
	TOTAL:	955.18	955.18	31.11	8.954	2.68
Main Walls						
M1		710.82	646.32	20.00		
M2		92.82	51.96	12.00		
M3		553.91	434.35	2.00		
M4		285.47	285.47	2.00		
M5		172.84	152.84	2.00		
M6		172.84	150.34	2.00		
M7		202.08	202.08	2.00		
	TOTAL:	2190.78	1923.36	2.96	178.096	53.37
Doors						
D1	Location: M1	19.50	19.50	12.00		
D2	M2	19.50	19.50	12.00		
D3	M3	19.50	6.69	12.00		
	TOTAL:	58.50	45.69	12.00	1.110	.33

Component	Area (Ft2) Gross	Net	R	Heat Loss Mil.BTU	% Annual Heat Loss
Basement walls above grade					
B1	24.67	24.67	20.00		

Wast

M3	1	100022	15.59	1.14		
TOTAL:			15.59	.00	4.004	1.20

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
21704.1 Ft3	.52 ACH	71.679	21.48

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area	= 5251.8 Ft2
Air Tightness Level is Loose (10.35 ACH @50 Pa.)	
Building Envelope is Sheltered from the Wind.	
Estimated Equivalent Leakage Area	= 342.4 in2
Normalized Leakage Area	= .0652 in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference	= 297 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference	= 467 cfm
ELA used to calculate Estimated Airflows	= 137.0 in2

F-326 VENTILATION REQUIREMENTS:

Kitchen,living,dining:	3 rooms @ 10 cfm	= 30 cfm
Utility rooms:	1 rooms @ 10 cfm	= 10 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	2 rooms @ 10 cfm	= 20 cfm
Bathrooms:	2 rooms @ 10 cfm	= 20 cfm
Other habitable rooms:	1 rooms @ 10 cfm	= 10 cfm
Basement Rooms:		20 cfm

F-326 Required continuous ventilation rate = 137.7 cfm (.38 ACH)

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel	: Natural Gas
Equipment	: Furnace/Boiler with continuous pilot
Manufacturer	:
Model	:
Output Capacity	= BTU/hr
Pilot Light energy consumption	= 1706.1 BTU/hr
Steady State Efficiency	= 78.0 %
Fan Mode : Auto	Fan Power 0. watts

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -23.8 F	= 5.48 BTU/hr/Ft3	=119006. BTU/hr
Gross Space Heating Load		=333.728 Mil.BTU
Sensible Daily Heat Gain From Occupants		= 2.00 kWh/day

B2		72.35	72.35	12.00		
B3		1.68	1.68	12.00		
	TOTAL:	98.70	98.70	13.33	2.045	.61

Full Basement Area

Upper Basement Walls

		22.50		20.00		
		244.66		12.00		
		3.36		1.14		
	TOTAL:	270.52		11.06	3.886	1.16

Lower basement walls

		32.81		20.00		
		519.99		12.00		
		97.06		1.14		
	TOTAL:	649.86		4.99	10.678	3.20

Perimeter area

		472.90		1.14		
	TOTAL:	472.90		.00	12.614	3.78

Centre area

		613.90		1.14		
	TOTAL:	613.90		.00	5.679	1.70

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss
South							
M1	1	320222	25.00	3.29			
M2	2	320222	21.36	3.07			
M3	2	320202	13.00	3.38			
M5	2	100022	20.00	1.17			
D3	1	320202	12.81	3.66			
TOTAL:			92.17	2.37		11.366	3.41
East							
M3	2	100022	31.19	1.14			
TOTAL:			31.19	.00		8.009	2.40
North							
M1	1	320222	20.00	3.25			
M3	1	100022	26.93	1.14			
M3	1	320222	13.35	3.15			
M6	2	100022	22.50	1.16			
TOTAL:			82.78	1.55		15.607	4.68

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)	Heat Loss Mil.BTU	% Annual Heat Loss

Estimated Annual Base Electrical Energy Consumption= 21024. MJ = 5840.0 kWh
Ventilator Electrical Consumption: Non Heating Hours= 0. MJ = .0 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel	Space Heating	Space Cooling	DHW Heating	Appliances	Total
Natural Gas (MCF)	392.7	.0	36.1	.0	428.9
Electricity (kWh)	.0	.0	.0	5840.0	5840.0

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

Usable Internal Gains	= 25.168 Mil.BTU
Usable Internal Gains Fraction	= 7.5 %
›le Solar Gains	= 29.348 Mil.BTU
Usable Solar Gains Fraction	= 8.8 %
Ventilation Equipment Electrical Contribution	= .000 Mil.BTU
Auxiliary Energy Required	=279.211 Mil.BTU
Space Heating System Load	=279.871 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 71.3 %
Furnace/Boiler Annual Energy Consumption	=392.716 Mil.BTU

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel : Natural Gas
Water Heating Equipment : Conventional gas/propane tank

Manufacturer	:
Model	:
Tank Capacity	= 40.0 Imp Gal
Seasonal Efficiency	= 45.0 %

*** ANNUAL DOMESTIC WATER HEATING SUMMARY ***

Daily Hot Water Consumption	= 52.0 Imp Gal /day
Estimated Domestic Water Heating Load	= 16.265 Mil.BTU
_MARY Domestic Water Heating Energy Consumption	= 36.144 Mil.BTU

*** LIGHTING AND APPLIANCES SUMMARY ***

Total Electrical Load	= 16.0 kWh/day
Average External Electrical Load	= .0 kWh/day
Total Annual Energy Consumption	= 5840. kWh

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	.0	.0	.0
Neither	.0	.0	.0
Cooling	.0	.0	.0
Total	.0	.0	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	= 414337. MJ =115093.7 kWh
Ventilator Electrical Consumption: Heating Hours	= 0. MJ = .0 kWh
timated Annual DHW Heating Energy Consumption	= 38134. MJ = 10592.9 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	= 452472. MJ =125686.5 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	= 95976. MJ = 26660.1 kWh

APPENDIX D

Specification List

Red Deer Project '94 Specification List

Photodocumentation Opportunity	Educational Opportunity	Product	Location	Manufacturer or Contractor	Type/Model	Reason for Choice
HOUSE INSPECTION		**HAZARDOUS MATERIALS**				
Walk through of existing house Testing and monitoring for hazardous materials	Identification and removal of hazardous materials	Asbestos shingles	Bump-outs at each end of house	National Building Inspections	Not Applicable	To determine what testing and monitoring should be carried out
		Asbestos tape	Furnace ducting			
		Asbestos putty	Windows			
		Lead	Interior paints			
		Radon	Basement of existing house			
Removal and disposal of hazardous materials		Asbestos shingles, tape and putty	As noted above	Connolley Insulation	OHS guidelines	Strict guidelines regarding the removal and disposal of asbestos
DEMOLITION		**MATERIALS RECYCLED**				
Removal of front and back porches	Demonstrate the type of demolition that is often necessary and explain why it is required Demonstrate recycling of existing house materials	None	Front and back of house	Not Applicable	Not Applicable	To allow for additions to front and back of house
Removal of brick chimney		Brick from front and back of house	Chimney			No longer required due to installation of high efficiency space and domestic hot water heating system
Removal of brick from front and back of house			Front and back of house			To rebrick front of house (the remainder of the house is in stucco)
Cutting of bathroom, kitchen, etc.		Bathtub	Upstairs bathroom			To allow for interior renovations and addition to back of house
Removal of existing plumbing, electrical, mechanical		Furnace	Existing basement			To allow for upgrades in these areas
Removal of existing insulation from attic		Fiberglass insulation	Attic			For use in crawlspace of new addition
		Vermiculite insulation				For use in landscaping and/or garden
Interior cleanup - removal of carpeting, plywood etc		None	Entire house			To allow for interior renovations
FOUNDATION		**FOUNDATION MATERIALS**				
Construction of footings and foundation walls	Using products made from recycled materials	Rebar	Front and back additions	Western Canada Steel	Rebar	Produced locally from 100% recycled products
Application of exterior damproofing	Keeping basement dry	Damproofing		Elsro Construction Products	Elsro 520	Water based emulsion product
Installation of weeping tile		Weeping tile		Big O	Weeping tile	Produced locally with 20% post consumer waste content
Installation of plastic, covered sump pits		Sump pits	Crawlspaces		Sump pits	Recommended product for this application
Installation of teleposts and footings	Replacement of rotting wooden supports	Teleposts and cement	Existing basement	Not available	Not available	Existing wood supports were set in cement and had rotted
Installation of under slab moisture barrier	Keeping basement dry Preventing soil gases from entering basement	Polyethylene - 6 mil	Existing basement Front and back additions	Layfield Plastics	CGSB certified	Recommended product for this application
Installation of interior foundation moisture barrier						
Installation of crawlspace floor moisture barrier						
Installation of slab		Concrete	Existing basement	Burnco	Not applicable	Not applicable

Red Deer Project '94 Specification List

Photodocumentation Opportunity	Educational Opportunity	Product	Location	Manufacturer or Contractor	Type/Model	Reason for Choice
STRUCTURAL		**STRUCTURAL MATERIALS**				
Construction of floor	Use of environmentally preferred products	Wood-I Joists	Front and back additions	Trus-Joist Macmillan	Silent Floor	Reconstituted product produced from aspen and poplar which
		Oriented strand board sheathing	Subfloor, walls and roof of front and back additions	Sturdiwood	Weyerhauser	are fast growing to reduce the use of dimentional lumber
Construction of roof system	Reducing building envelope heat loss	High-heel trusses	Front and back additions	Home Truss, Red Deer	High-heel truss	Allows for increased insulation levels over the wall
Installation of windows	Selection & benefits of high performance windows	High performance windows	Existing house	All Weather Windows	Super Edge Plus	Triple, Low-E, Argon, vinyl frame, super spacer ER rating = -3.82
			Front and back additions	Caradon (formerly Indal)	Advantage	Triple, Low-E, Argon, vinyl frame, swiggle bar ER rating = -3.82
Installation of doors	Selection & benefits of high performance doors	Steel insulated door	Existing house and additions	All Weather Windows	Not available	Foam core doors provide relatively high insulation levels
Installation of asphalt shingles	Efficient use of existing house materials	Shingles	Front and back additions	IKO Industries	Gerd Seal 15	Allowed roof of existing house to be used
Installation of insulation stops	Attic ventilation issues	Insulation stops	Existing house and back addition	Not available	Not available	Readily available
Installation of the cellulose insulation system	Reducing building envelope heat loss	Cellulose fibre insulation	Existing house - walls	Can-Cel Industries, Edmonton	Wal-Bar	Produced from 100% post consumer recycled material
	Reducing building envelope air leakage		Existing house and back addition			
Installation of the fiberglass insulation system	Recycling of product from existing house	Recycled fiberglass insulation	Front and back additions	Fiberglas Canada	From attic of existing house	Allows to reuse existing materials
		Fiberglass insulation	Front and back additions - walls	Manville Canada	Gold	Contains recycled glass material
			Existing house - basement			
Installation of stucco finish	Recoating and existing stucco surface	Stucco cement plus white glue	Existing house and additions	Not available	Not applicable	Eliminated need to remove existing stucco
Installation of brick finish	Recycling materials from existing house	Existing brick	Front and back of house	Not applicable		Allowed use of brick from existing building
AIR BARRIER AND VAPOUR RETARDER		**AIR BARRIER AND VAPOUR RETARDER MATERIALS**				
Installation of main floor joist air barrier system in the new additions	Reducing building envelope air leakage Proper installation of air barrier systems	Tyvek	Front and back additions	Dupont Canada	Tyvek	Acts as an air barrier and not a vapour retarder so that it can be
		Acoustical sealant		Tremco	Acoustical sealant	used with conventional framing techniques
Installation of main floor joist air barrier system in the existing house	Use of environmentally preferred products	Drywall and acoustical sealant	Existing house	Stanley Bostich	SB 500	Prevents air leakage through rim joist area from the outside and down through the balloon framed wall
Installation of second floor joist air barrier system in the existing house		Plywood and acoustical sealant	Existing house	Tremco	Acoustical sealant	
Installation of window air barrier and vapour retarder system		Polyurethane spray foam	Existing house Front and back additions	Abisko Manufacturing	Foamit	Provides an easy to apply, insulative sealant that ensures a continuous air barrier
Installation of wall and ceiling air barrier and vapour retarder system		Polyethylene - 6 mil	Front and back additions	Layfield Plastics	CGSB certified	Provides continuous air barrier and vapour barrier retarder
		Polyhats	Crawls spaces			
		Acoustical sealant	Existing basement	Tremco	Acoustical sealant	Seals joints in air barrier and does not dry out over time
Sealing and insulating attic hatch		Gasket	Existing house	Not available	Not available	Prevent air leakage and heat loss between the attic and the house
			Back addition			

Red Deer Project '94 Specification List

Photodocumentation Opportunity	Educational Opportunity	Product	Location	Manufacturer or Contractor	Type/Model	Reason for Choice
PLUMBING		**PLUMBING SUPPLIES**				
Installation & air sealing of new and existing plumbing	Advances in plumbing such as plastic vs copper	Plastic poly-B pipe	Existing house and back addition	Plasco Manufacturing	Not applicable	Product typically used in Alberta
	Air sealing plumbing penetrations	Polyurethane spray foam	At exterior walls	Abisko Manufacturing	Foamit	Provides an easy to apply insulative, air barrier sealant
Installation of backwater valve and trap primer	Keeping basement dry	Backwater valve	Existing basement	Not available	Not available	Readily available
Installation of floor drains for HRV and furnace	Providing drains for condensing appliances	ABS pipe				
Installation of low flow plumbing fixtures	Water conservation	Low flow toilet	Main floor bathroom	American Standard	Cadet - AF-2606	13.25 Liter or less water consumption
						Barrier free with 16" high for handicapped
			Ensuite bathroom	American Standard	Cadet - AF-2164.135F	6 Liter or less water consumption
		Low flow showerhead	Main floor bathroom	Moen	3127/97466	9.8 L/min (2.15 Imp. GPM) at 5.5 kg/cm² (80 psi)
		Low flow faucets	Kitchen	American Standard	Not available	8.3 L/min (1.84 Imp. GPM) at 4.15 kg/cm² (60 psi)
			Ensuite bathroom	Moen	4570/97376	8.3 L/min (1.84 Imp. GPM) at 4.15 kg/cm² (60 psi)
Installation and sealing of water heating system	Selecting energy saving hot water heaters	Power vented hot water heater	Existing house - basement	John Woods	Superflue JW 520 PV	To achieve maximum efficiency from heating system
	Air sealing exterior vents	Polyurethane spray foam	Existing house	Abisko Manufacturing	Foamit	Provides an easy to apply, insulative, air barrier sealant
	Health issues regarding proper installation					
ELECTRICAL		**ELECTRICAL SUPPLIES**				
Relocation of electrical panel to interior wall	Minimizing air leakage around electrical panel	Electrical panel	Existing house	Square D Company	Not applicable	Readily available
Installation of energy saving appliances	Selecting energy saving appliances	Stove	Kitchen	Maytag	CRE9500BDE	Energuide Rating = 840 kWh/year
		Refrigerator	Kitchen	Maytag	RTS1900DAE	Energuide Rating = 695 kWh/year; 88% CFC free
		Dishwasher	Kitchen	Maytag	DWU9400ABE	Energuide Rating = 684 kWh/year
		Clothes washer	back addition	Maytag	LAT7304ABE	Energuide Rating = 840 kWh/year
		Clothes dryer	back addition	Maytag	LDE7304ADE	Energuide Rating = 937 kWh/year
Installation of built-in vacuum system	Proper venting of unit to outside	Power vacuum	Throughout house	Dynovac	Not applicable	Manufacturer in Red Deer
Installation of recycled light fixtures	Tasteful use of recycled products	Existing light fixtures	Entrance, hall, upstairs bath	Not available		Supplied by local recycling company
Installation of energy efficient lighting	Electrical conservation through lighting	Fluorescent lighting	Kitchen, bedrooms, upstairs hall dining room			Reduces energy consumption
		Halogen lighting	Pot lights in family/kitchen area			
		Dimmer switches	Family and living rooms			
MECHANICAL		**MECHANICAL SUPPLIES**				
Installation of exterior weatherhoods	Proper air sealing techniques	Rubber gasket	Throughout house	Not available	Not applicable	Readily available
Installation and sealing of ductwork	Ensuring efficient space heating and ventilation	Duct tape				
Installation & air sealing of high efficiency furnace	Selecting higher efficiency furnaces	High efficiency furnace	Existing house - basement	Lennox Industries	G26Q3 - 100	90% fuel efficient eliminating need for combustion air line
	Reducing potential for backdrafting				Condensing	Electronic ignition eliminating continuously burning standing pilot
Installation & air sealing of heat recovery ventilator	Ventilation and indoor air quality	Heat recovery ventilator	Existing house	Venmar Ventilation Inc.	Flair 5585	High efficient, compact unit

Red Deer Project '94 Specification List

Photodocumentation Opportunity	Educational Opportunity	Product	Location	Manufacturer or Contractor	Type/Model	Reason for Choice
PAINTING		**PAINTS, STAINS, REFINISHING PRODUCTS, PAINT STRIPPERS**				
Spraying underside of existing floor	Reducing basement odours in existing houses	Sealant	Basement	Glidden	Lifemaster 2000	Contains no VOCs and is water-based
Stripping paint from banister and newel post	Proper safety precautions for corrosive product	Paint stripper	Banister and newel post	Circa	Not applicable	Highly effective and least expensive although toxic
Sealing underside of countertops	Reducing formaldehyde offgassing	Paint	Kitchen and bathrooms	Glidden	Lifemaster 2000	Contains no VOCs and is water-based
Painting interior	Selection of environmentally preferred products Products for chemically sensitive individuals	Paint	Main floor walls & ceiling	Benjamin Moore Latex	Regal	Contain less than 250 g/L of VOCs and is water-based Easy to apply decorative finishes to
			2nd floor	Glidden	Lifemaster 2000	Contains no VOCs and is water-based
FLOORING		**FLOORING MATERIALS**				
Refinishing hardwood floors	Efficient use of existing house materials Selection of environmentally preferred products Products for chemically sensitive individuals	Hardwood	Existing house except kitchen	Existing hardwood	Not applicable	Preserve existing hardwood
		Wood filler		Bona	Pacific Wood Filler	Contain less than 350 g/L of VOCs
		Sealer		Bona	Pacific High Bond Sealer	Contain less than 250 g/L of VOCs
		Curing agent		Bona	Pacific Ultra Cure	Contain less than 350 g/L of VOCs
Finishing stairs		Texture	Stairs to 2nd floor	Bona	Woodline Texture	Contain less than 350 g/L of VOCs
Installation of new flooring	Selection of environmentally preferred products	Marmoleum	Main floor other than hardwood Existing house - second floor	Not available	Not applicable	Natural raw materials; biodegradable and durable, production waste reusable
INTERIOR FINISH		**INTERIOR PRODUCTS**				
Installation of cabinets	Selection of environmentally preferred products	Vinyl wrap cabinets	Kitchen and bathrooms	Westridge Cabinets	Not applicable	No emissions because sealed with vinyl wrap Water based contact cement
Installation of countertops		Laminate	Kitchen and bathrooms	Pionite		Durable and cost effective Supplier recycles shipping cardboard
Installation of ceramic tiles		Ceramic tiles	Around tub and shower	Not available		Low emissions, easy to maintain, durable

APPENDIX E

1. Billing History and Monthly Meter Readings
2. Blower Door Test Results
3. AUDIT2000 Computer Simulation Results
4. Indoor Air Quality Results
5. EMF Report

Gas Consumption (cu ft)

```
                                ACCOUNT HISTORY - AH                          UAFL PROD
01 0008733 2 01 7                STATUS 03  CYCLE 01  DDUNI.D 0  RATE 1A1A  OL ACCT N
¢PARKLAND COMMUNITY LIVING                                                    BUDGET  N
& SUPPORT SOCIETY              AGENCY 411  COMM 0111 MR ID  5346 ROUTE        5009/1650
     4725  56                 ST    PED BEER    AB T4N2J9          KEY 0     EST CD  0
MTR            593380  IN/CH 94/09/15     #MTRS    1 LOC OSEAS  BILL        94/11/02
OCCUPIED 94/09/15     SPEC USE       ANN CONS        186          DUE         94/11/22
REBILL                                      POT PENALTY       1.57  A/R          49.66
 TIME     READ     DAYS    READING  TYP  B CONST     CONSUMPTION        NET BILL
 1117   941028       28         8A   A   1.04512            5.23            31.33
        940930       15         3E   E   1.05462            3.16            17.46
        940915       49          A   A   1.05145             .00            22.90
        940429       63        82A   A   1.03563           43.44           178.00
 1157   940225       25        40A   A   1.03563           44.53           175.31
        940131       32       997E   E   1.03774           34.25           136.49
 1125   931230       29       964A   A   1.04934           22.04            92.54
        931201       30       943E   E   1.05989           21.20            89.51
        931101       32       923E   E   1.04301           12.52            50.64
        930930       29       911E   E   1.05251            7.37            35.05
        930901       29       904E   E   1.04829            4.19            25.63
        930803       35       900E   E   1.04618            4.16            25.60
  937   930629       90       896A   A   1.05778            6.35            58.23

TRANSACTION TX                 ACCOUNT 01 0008733 2 01      METER
```

DARYLE WEBER-
342-2677 FAX

1192 0213-0194-1

Electrical Data (kwh)

BH C I S B I L L I N G H I S T O R Y
ACCT 00-005-022-539-05-01 NAME [redacted]
SERV 4725 56 ST CYCLE 12 MTR NBR 12243 TEST 840101 TEST RSN
E61 ON 930301 STATUS 08
R10 ON 930301 OFF 940502

RDG-DTE	MTR-RDG	DYS	CONSUMP	B	USAGE-REV	REBATE	RECYCLE	GST	MTR-BILL
940502	049641	18	385	C	28.55	1.28-	1.89	1.91	31.07
940414	049256	34	713	A	51.26	2.51-	3.15	3.41	55.31
940311	048543	29	705	A	50.85	2.64-	3.15	3.37	54.73
940210	047838	28	837	A	57.64	3.00-	3.25	3.82	61.71
940113	047001	34	452	E	37.82	1.97-	3.25	2.51	41.61
931210	046549	28	173	A	23.45	1.22-	3.25	1.56	27.04
931112	046376	30	368	E	33.49	1.74-	3.25	2.22	37.22
931013	046008	29	794	A	55.43	2.88-	3.25	3.68	59.48
930914	045214	33	355	E	32.82	1.71-	3.25	2.18	36.54
930812	044859	30	533	A	41.99	2.18-	3.25	2.79	45.85
930713	044326	33	352	E	32.67	1.70-	3.25	2.17	36.39
930610	043974	29	8	A	8.35	.43-	3.25	.55	11.72
930512	043966	26	54	A	11.58	.60-	3.25	.77	15.00
930416	043912	35	137	A	20.82	1.08-	3.25	1.38	24.37
930312	043775	11	37	C	6.16	.32-	1.19	1.39	8.42
930301	043738	19	329	Z	26.15	1.36-	2.06	1.74	28.59
930210	043409	28	624	Z	46.67	2.43-	3.25	3.10	50.59
930113	042785	34	720	Z	51.62	2.46-	3.25	3.44	55.85

NXT FMT

BH C I S B I L L I N G H I S T O R Y
ACCT 00-005-022-539-05-02 NAME [redacted]
SERV 4725 56 ST CYCLE 12 MTR NBR U0558 TEST 860101 TEST RSN
W58 ON 930301 STATUS 08
S61 ON 930301 OFF 940502 G61 ON 930301 OFF 940502

RDG-DTE	MTR-RDG	DYS	CONSUMP	B	USAGE-REV	SEWAGE	GARBAGE	GST	MTR-BILL
940502	000469	18	1900	C	25.57	8.47	3.71	.00	37.75
940414	000450	34	200	E	11.76	14.11	6.19	.00	32.06
940311	000448	29	100	E	10.69	14.11	6.19	.00	30.99
940210	000447	28	200	E	11.42	14.11	6.19	.00	31.72
940113	000445	34	300	E	12.43	14.11	6.19	.00	32.73
931210	000442	28	200	E	11.42	14.11	6.19	.00	31.72
931112	000440	30	200	E	11.42	14.11	6.19	.00	31.72
931013	000438	62	500	C	23.85	28.22	12.38	.00	64.45
930914	000439	33	600	N	15.46	14.11	6.19	.00	35.76
930812	000433	30	300	E	12.43	14.11	6.19	.00	32.73
930713	000430	33	400	E	13.44	14.11	6.19	.00	33.74
930610	000426	29	300	E	12.43	14.11	6.19	.00	32.73
930512	000423	26	200	E	11.42	14.11	6.19	.00	31.72
930416	000421	35	300	E	12.43	14.11	6.19	.00	32.73
930312	000418	11	100	E	4.44	5.17	2.27	.00	11.88
930301	000417	19	700	Z	12.36	8.94	3.53	.00	24.83
930210	000410	28	200	Z	10.83	14.11	5.58	.00	30.52
930113	000408	34	300	Z	11.79	14.11	5.58	.00	31.48

NXT FMT

Water Consumption Data

(units = cubic feet)

C I S A C C T L E V E L B I L L I N G

00-005-022-539-06-01 NAME PARKLAND CLASS STATUS 03

SERV 4725 56 ST EPP-AMT CREDIT-HIST 35435433001 3

CYCLE 12

DATE	DYS	B	ELECTRIC	GST	WATER	m³/30	SEWER	GARBAGE	OTHER	TOTAL-NET
951116	30	B	57.94	4.06	19.23	26	14.11	9.28	.00	104.62
951017	32	A	68.39	4.79	30.60	57	14.11	9.28	.00	127.17
950915	29	B	49.80	3.49	17.75	22	14.11	9.28	.00	94.43
950817	31	A	65.03	4.55	17.75	22	14.11	9.28	.00	110.72
950717	31	B	48.27	3.38	20.33	29	14.11	9.28	.00	95.37
950616	36	A	66.02	4.62	36.12	72	14.11	9.28	.00	130.15
950511	30	A	63.25	4.43	18.85	25	14.11	9.28	.00	109.92
950411	32	A	67.44	4.72	21.06	31	14.11	9.28	.00	116.61
950310	28	A	62.18	4.35	19.96	28	14.11	9.28	.00	109.88
950210	25	A	54.51	3.82	17.39	21	14.11	9.34	.00	99.17
950116	34	A	72.66	5.09	22.53	35	14.11	9.34	.00	123.73
941213	29	A	57.76	4.04	14.08	12	14.11	9.34	.00	99.33
941114	32	A	43.49	3.04	10.04	1	14.11	.00	.00	70.68
941013	10	C	29.38	2.06	3.95		4.70	.00	.00	40.09
940914	33		51.90	3.63	.00		.00	.00	.00	55.53
940812	30		11.16	.78	.00		.00	.00	.00	11.94

NXT PMT

Main Meter

3104 / 30 m³

353145 7

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To D. Webber	From Bunny
Co	Co City of R. D
Dept	Phone 342-8107
Fax # 342-2677	Fax # 342-7665

C I S A C C T L E V E L B I L L I N G

00-005-022-539-06-01 NAME PARKLAND CLASS STATUS 03

SERV 4725 56 ST EPP-AMT CREDIT-HIST 3543543300013 CYCLE 12

DATE	DYS	B	ELECTRIC	GST	WATER m^3 / 30	SEWER	GARBAGE	OTHER	TOTAL-NET
951116	30	B	57.94	4.06	19.23 26	14.11	9.28	.00	104.62
951017	32	A	68.39	4.79	30.60 57	14.11	9.28	.00	127.17
950915	29	B	49.80	3.49	17.75 22	14.11	9.28	.00	94.43
950817	31	A	65.03	4.55	17.75 22	14.11	9.28	.00	110.72
950717	31	B	48.27	3.38	20.33 29	14.11	9.28	.00	95.37
950616	36	A	66.02	4.62	36.12 72	14.11	9.28	.00	130.15
950511	30	A	63.25	4.43	18.85 25	14.11	9.28	.00	109.92
950411	32	A	67.44	4.72	21.06 31	14.11	9.28	.00	116.61
950310	28	A	62.18	4.35	19.96 28	14.11	9.28	.00	109.88
950210	25	A	54.51	3.82	17.39 21	14.11	9.34	.00	99.17
950116	34	A	72.66	5.09	22.53 35	14.11	9.34	.00	123.73
941213	29	A	57.76	4.04	14.08 12	14.11	9.34	.00	99.33
941114	32	A	43.49	3.04	10.04 1	14.11	.00	.00	70.68
941013	10	C	29.38	2.06	3.95	4.70	.00	.00	40.09
940914	33		51.90	3.63	.00	.00	.00	.00	55.53
940812	30		11.16	.78	.00	.00	.00	.00	11.94

NXT RMT

Meter Reading
104 / 30 m³

Consumption
3531457

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To D. Webber	From Bernard
Co.	Co City of RD
Dept.	Phone 342-8107
Fax # 342-2677	Fax # 342-7665

howell-mayhew engineering, inc.

15006 · 103 AVENUE
EDMONTON · ALBERTA · T5P 0N8
(403) 484·0476

AIR LEAKAGE TEST REPORT

November 01, 1994

Name: Red Deer Renovation Address: Red Deer

Technician: W. Mayhew Project: Project '94

Volume = 612 m^3 Envelope Area: 488 m^2

House pressure:
Initial = 0 Pa
Final = 0 Pa
Backgrnd = 0 Pa

Comments on the wind speed: 10 km/h
Barometric pressure = 93.92 kPa
Indoor air temperature = 18 °C
Outdoor air temperature = -2 °C

Reading #	Measured house pressure (Pa)	Corrected house pressure (Pa)	Fan pressure (Pa)	# holes plugged (-1=open)	Corrected Flow (cfm)	Maximum Error (must be < 6%) (%)
1.	50	50.0	270	0	1479	.3
2.	44	44.0	230	0	1368	1.2
3.	39	39.0	190	0	1247	.2
4.	36	36.0	160	0	1147	2.7
5.	30	30.0	125	0	1017	2.2
6.	24	24.0	100	0	913	2.3
7.	20	20.0	75	0	794	.8

Air Leakage Test Results

C = 101.0 r = .997 (must be > 0.990)

n = .686 (between 0.5 and 1.0) RSE_{10} = 3.4% (must be < 7%)

Q_{50} = 1475 cfm Air $Change_{50}$ = 4.09 per hour
Q_{20} = 787 cfm
Q_{10} = 489 cfm Normalzed Leakage Area = 1.9 cm^2/m^2 (must be<0.7)
Q_5 = 304 cfm Equivalent Leakage Area = 144 in^2 at 10 Pa
Equivalent Hole Diameter = 13.5 in

Comments: (Major leakage sites, recommendations...)

A major leakage area could not be found. Leakage under baseboards and through interior wall electrical outlets on the second floor of the existing house suggest that the rim joist area and the ceiling were not sealed as well as they could have been. The balloon framing of the original house would appear to the source of the leakage problems that still exist.

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*****************************************
*                                       *
*              AUDIT2000                *
*            Version 7.11               *
*              CANMET                   *
*       Natural Resources CANADA        *
*             Sep 20, 1995              *
*           Reg. # BETAC016             *
*****************************************
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File = C:\HME\9506-REP\RENO.HDF

Weather Data for Rocky 1995, ALBERTA

Builder Code =PROJECT 94
Data Entry by: Howell-Mayhew Engineering Date of entry 06/02/1996

Client name: Parkland CLASS
Street address:
City: Red Deer Region: Alberta
Postal code: Telephone:

*** GENERAL HOUSE CHARACTERISTICS ***

House type: Single detached
Number of storeys: One and a half
Wall construction: Balloon frame
Year House Built: 1990-
Wall colour: Default 0.40 Value .400
Plan shape: Rectangular Front orientation North

SOIL TYPE: Normal conductivity: dry sand, loam, clay, low water table

HOUSE THERMAL MASS LEVEL: (A) Wood frame construction, 12.5 mm (0.5 in.) gyproc walls and ceiling, wooden floor

Effective mass fraction 1.000

Occupants : 4 Adults for 75.0 % of the time
0 Children for .0 % of the time
0 Infants for .0 % of the time

Sensible Internal Heat Gain From Occupants = 4.80 kWh/day

*** HOUSE TEMPERATURES ***

Heating Temperatures Main Floor = 69.8 F
Basement = 64.4 F
TEMP. Rise from 69.8 F = 6.3 F

Basement is- Heated: Yes Cooled: No Separate T/S: No

Indoor design temperatures for equipment sizing
Heating = 71.6 F
Cooling = 75.2 F

*** FOUNDATION CONSTRUCTION CHARACTERISTICS ***

Foundation Construction	Attachment Sides	Insulation Placement	Volume Ft3
Full Basement	None	Interior	6725.3

*** WINDOW CHARACTERISTICS ***

Direction	Seq #	Loc. Code	# of Windows	Type	Window Width Ft	Window Height Ft	OverHang Width Ft	Header Height Ft	SHGC	Curtain Factor
South	1	M1	1	333204	5.000	5.000	1.00	2.00	.5760	1.000
	2	M2	2	333204	2.670	4.000	1.00	2.00	.5414	1.000
	3	M3	2	333204	1.000	6.500	1.00	2.00	.4569	1.000
	4	M5	2	333204	2.500	3.500	1.00	5.50	.5322	1.000
	5	D3	1	333204	2.330	5.500	1.00	6.25	.5429	1.000
East	1	M3	2	333204	2.670	5.840	1.00	7.33	.5530	1.000
	2	D1	2	333204	.500	3.000	10.60	.50	.2856	1.000
North	1	M1	1	333204	5.000	4.000	4.00	1.00	.5682	1.000
	2	M3	1	333204	4.580	5.670	8.33	.50	.5768	1.000
	3	M3	1	333204	2.670	5.000	1.00	.50	.5488	1.000
	4	M6	2	333204	2.500	4.500	1.00	5.50	.5415	1.000
West	1	M3	1	333204	2.670	5.840	1.00	7.33	.5530	1.000
	2	D2	1	333204	2.500	2.500	1.00	4.33	.5154	1.000

*** WINDOW PARAMETER CODES SCHEDULE ***

Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
1 333204	Triple/Triple with 1 coat, Low-E .20 (Hard1), 13 mm Argon, Insulating, Picture, Vinyl, ER* = 9.2, Eff. R= .72

Window Standard Energy Rating estimated for assumed dimensions, and
Air tightness type: CSA - A1; Leakage rate = 2.79 m3/hr/m

*** BUILDING PARAMETER DETAILS ***

CEILING COMPONENTS

	Construction Type	Code Type	Roof Slope	Heel Ht. Ft	Section Area Ft2	R-Value R
C1	Attic/Gable	2201691000	12.00 / 12	.50	409.26	37.06
C2	Attic/Hip	2203391000	4.00 / 12	.67	545.90	36.65

WALL COMPONENTS

	Wall Type Code	Lintel Type	Facing Dir	Number of Corners	Number of Inter.	Height Ft	Perim. Ft	Area Ft2	R-Value R
	Main Walls								
M1	1211301161	101	N/A	6	3	8.83	80.5	710.82	15.52
M2	1201201161	101	N/A	0	0	8.83	10.5	92.71	8.36
M3	1201901561	101	N/A	4	3	8.83	62.7	553.91	9.93
M4	1201901561	101	N/A	4	3	5.58	51.2	285.47	10.88
M5	1201901561	101	N/A	4	3	3.95	51.2	202.28	10.13
M6	1201901561	101	N/A	0	1	8.41	20.6	172.84	10.47
M7	1201901561	101	N/A	0	1	8.41	20.6	173.25	11.35
	Basement Walls above grade								
B1	1502300451	N/A	N/A	1	0	.92	141.4	130.10	20.76
B2	11BMT2X4	N/A	N/A	2	0	1.00	24.7	24.67	17.53
B3	11BMT2X4	N/A	N/A	2	0	1.00	60.2	60.20	17.59
B4	11BMT2X4	N/A	N/A	2	0	1.00	66.2	66.17	17.59
B5	1610000050	N/A	N/A	0	0	1.00	.8	.83	1.60
	Upper Basement Walls								
1	11BMT2X4	N/A	N/A	2	0	2.00	11.3	22.50	18.38
2	11BMT2X4	N/A	N/A	2	0	2.00	60.2	120.40	18.72
3	11BMT2X4	N/A	N/A	2	0	2.00	66.2	132.34	18.73
4	1610000000	N/A	N/A	0	0	2.00	1.7	3.40	1.34

WALL COMPONENTS

	Wall Type Code	Lintel Type	Facing Dir	Number of Corners	Inter.	Height Ft	Perim. Ft	Area Ft2	R-Value R
Lower basement walls									
1	11BMT2X4	N/A	N/A	2	0	1.33	24.7	32.81	17.90
2	11BMT2X4	N/A	N/A	2	0	4.25	60.0	255.00	19.68
3	11BMT2X4	N/A	N/A	2	0	1.33	66.2	88.01	17.99
4	1610000000	N/A	N/A	0	0	2.00	1.7	3.36	1.34
5	1610000000	N/A	N/A	0	0	2.92	32.0	93.44	1.34

FLOORS

	Seq #	Construction Type	Section Area Ft	R-Value R
Full Depth Floor Perimeter	1	3600000000	472.90	1.16
Full Depth Floor Centre	1	3600000000	613.90	1.16
Floors above Basement	1	4230000340	1086.00	3.91

DOORS

	Location	Type	Height Ft	Width Ft	Gross Area Ft2	R-value R
D1	M1	Steel polyurethane core	6.79	3.00	20.37	6.47
D2	M2	Steel polyurethane core	6.79	3.00	20.37	6.47
D3	M3	Steel polyurethane core	6.79	3.00	20.37	6.47

*** Wall PARAMETER CODES SCHEDULE ***

	Code	Description (Str., typ/size, Spac., Insl, 2, Int, Sheath, Ext., Studs)
1	1211301161	Wood frame, 38 x 140 mm (2 x 6 in), 400 mm (16 in), RSI 3.5 (R 20) Batt, None, 12 mm (0.5 in) Gypsum board, Waferboard/OSB 9.5 mm (3/8 in), Stucco, 3 studs
2	1201201161	Wood frame, 38 x 89 mm (2 x 4 in), 400 mm (16 in), RSI 2.1 (R 12) Batt, None, 12 mm (0.5 in) Gypsum board, Waferboard/OSB 9.5 mm (3/8 in), Stucco, 3 studs
3	1201901561	Wood frame, 38 x 89 mm (2 x 4 in), 400 mm (16 in), 23.7 RSI/m (R 3.4/in) Blown cell., None, 12 mm (0.5 in) Gypsum board, Plywood/Particle board 12.7 mm (1/2 in), Stucco, 3 studs
4	1502300451	Composite wood joist, 38 x 241 mm (2 x 9.5 in), 487 mm (19 in), RSI 3.5 (R 20) Batt, None, None, Plywood/Particle board 9.5 mm (3/8 in), Mortar, 3 studs
5	1610000050	Solid, 200 mm (8 in) Concrete, None, None, None, None, None, Mortar, 2 studs
6	1610000000	Solid, 200 mm (8 in) Concrete, None, None, None, None, None, None, 2 studs

*** Ceiling PARAMETER CODES SCHEDULE ***

	Code	Description (Str., typ/size, Spac., Insl, 2, Int, Sheath, Ext., Studs)
1	2201691000	Wood frame, 38 x 89 mm (2 x 4 in), 400 mm (16 in), RSI 3.5 (R 20) Blown cellulose, Same as Insulation Layer 1, 12 mm (0.5 in) Gypsum board, N/A, N/A, N/A
2	2203391000	Wood frame, 38 x 89 mm (2 x 4 in), 600 mm (24 in), RSI 3.5 (R 20) Batt, Same as Insulation Layer 1, 12 mm (0.5 in) Gypsum board, N/A, N/A, N/A

*** Exterior Floor PARAMETER CODES SCHEDULE ***

	Code	Description (Str., typ/size, Spac., Insl, 2, Int, Sheath, Ext., Drop Floors)
1	3600000000	Solid, 75 mm (3 in) Concrete, None, None, None, None, None, None, No

*** Interior Floor PARAMETER CODES SCHEDULE ***

	Code	Description (Str., typ/size, Spac., Insl, 2, Int, Sheath, Ext., Drop Floors)
1	4230000340	Wood frame, 38 x 235 mm (2 x 10 in), 305 mm (12 in), None, None, None, Waferboard/OSB 15.9 mm (5/8 in), Tile-linoleum, No

*** USER-DEFINED STRUCTURE CODES SCHEDULE ***

	Code	Description
1	11BMT2X4	Standoff 2x4, R20 Batt

*** Lintel PARAMETER CODES SCHEDULE ***

	Code	Description (Type, Material, Insulation)
1	101	Double, Wood, Same as wall framing cavity

Roof Cavity Inputs

Gable Ends	Total Area	136.4 Ft2
Sheathing Material: Plywood/Part. bd 9.5 mm (3/8 in)		.47 R
Exterior Material: Hollow metal/vinyl cladding		.62 R
Sloped Roof	Total Area	1154.2 Ft2
Sheathing Material: Plywood/Part. bd 12.7 mm (1/2 in)		.63 R
Roofing Material: Asphalt shingles		.44 R

Roof colour: Medium brown 0.84 Absorptivity: .840
Total cavity volume 2557.9 Ft3 Ventilation rate .50 ACH/hr

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window (Shutter)
South				
M1	1	333204	25.00	4.21
M2	2	333204	21.36	3.98
M3	2	333204	13.00	3.50
M5	2	333204	17.50	3.93
D3	1	333204	12.82	3.99
East				
M3	2	333204	31.19	4.05
D1	2	333204	3.00	3.03
North				
M1	1	333204	20.00	4.16
M3	1	333204	25.97	4.22
M3	1	333204	13.35	4.03
M6	2	333204	22.50	3.98

WINDOWS

Orientation Location	Number	Type (Code)	Total Area(Ft2)	R Window	(Shutter)
West					
M3	1	333204	15.59	4.05	
D2	1	333204	6.25	3.83	

*** BUILDING PARAMETERS SUMMARY ***

Component	Area (Ft2) Gross	Net	Effective R	Heat Loss Mil.BTU	% Annual Heat Loss
ZONE 1 : ABOVE GRADE					
Ceiling	955.16	955.16	36.83	6.436	4.71
Main Walls	2191.28	1924.70	11.63	48.012	35.16
Doors	61.12	39.06	6.47	1.855	1.36
South windows	89.68	89.68	3.95	6.973	5.11
East windows	34.19	34.19	3.94	2.670	1.95
North windows	81.82	81.82	4.10	6.129	4.49
West windows	21.84	21.84	3.99	1.684	1.23
		ZONE 1 Totals:		73.759	54.01
INTER-ZONE Heat Transfer : Floors Above Shallow and Full Basement	1086.00	1086.00	3.91	19.947	
ZONE 2 : SHALLOW / FULL BASEMENT					
Basement Walls above grade	281.97	281.97	18.34	4.060	2.97
Upper Basement Walls	278.64	278.64	16.15	2.442	1.79
Lower Basement Walls	472.62	472.62	5.14	6.402	4.69
Full Depth Floor Perimeter	472.90	472.90	1.16	10.415	7.63
Full Depth Floor Centre	613.90	613.90	1.16	4.685	3.43
		ZONE 2 Totals:		28.004	20.51

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
21704.1 Ft3	.500 ACH	34.797	25.48

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 5266.5 Ft2
Air Leakage Test Results at 50 Pa.(0.2 in H2O) = 4.09 ACH
Equivalent Leakage Area @ 10 Pa. = 144.0 in2

Terrain Description
@ Weather Station : Open flat terrain, grass
@ Building site : City centre

Height
Anemometer 32.8 Ft
Bldg. Eaves 13.9

Local Shielding- Walls: Heavy
Flue : Light local shielding

Leakage Fractions - Ceiling: .200 Walls: .600 Floors: .200

Normalized Leakage Area @ 10 Pa. = .0273 in2/ft2

Estimated Airflow to cause a 5 Pa Pressure Difference = 313 cfm
Estimated Airflow to cause a 10 Pa Pressure Difference = 491 cfm

*** F326 VENTILATION REQUIREMENTS ***

Kitchen,living,dining:	3 rooms @ 10 cfm	= 30 cfm
Bedrooms:	1 rooms @ 20 cfm	= 20 cfm
Bedrooms:	2 rooms @ 10 cfm	= 20 cfm
Bathrooms:	2 rooms @ 10 cfm	= 20 cfm
Other habitable rooms:	1 rooms @ 10 cfm	= 10 cfm
Basement Rooms:		20 cfm

*** CENTRAL VENTILATION SYSTEM ***

System Type : Heat recovery ventilator (HRV)
Manufacturer: Venmar Ventilation, Inc.
Model Number: Flair HRV 5585

Fan and Preheater Power at 32.0 F	=	158. Watts
Fan and Preheater Power at -13.0 F	=	176. Watts
PreHeater Capacity:	=	0. Watts
Sensible Heat Recovery Efficiency at 32.0 F	=	84. %
Sensible Heat Recovery Efficiency at -13.0 F	=	72. %
Total Heat Recovery Efficiency in Cooling mode	=	22. %

Low Temperature Ventilation Reduction = 13. %
Low Temperature Ventilation Reduction: Airflow Adjustment= 8 cfm (6.3 %)

NO Vented combustion appliance specified

Ventilation Supply Duct
Location : Basement Type : Flexible
Length 8.0 Ft Diameter 7.0 In
Insulation 4.0 R Sealing Characteristics : Sealed

Ventilation Exhaust Duct
Location : Basement Type : Flexible
Length 8.0 Ft Diameter 7.0 In
Insulation 4.0 R Sealing Characteristics : Sealed

*** AIR LEAKAGE AND VENTILATION SUMMARY ***

F326 Required continuous ventilation rate = 127.1 cfm (.35 ACH)
Central Ventilation Rate (Balanced) = 100.0 cfm (.28 ACH)
Total house ventilation is Balanced

Gross Air Leakage and Ventilation Energy Load	=	62.120 Mil.BTU
Seasonal Heat Recovery Ventilator Efficiency	=	76.424 %
Estimated Ventilation Electrical Load: Heating Hours	=	4.622 Mil.BTU
Estimated Ventilation Electrical Load: Non-Heating Hours	=	.043 Mil.BTU
Net Air Leakage and Ventilation Energy Load	=	37.109 Mil.BTU

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Natural Gas
Equipment : Condensing furnace/boiler
Manufacturer : Lennox Industries
Model : G26Q3-100
Output Capacity = 93999.7 BTU/hr

Steady State Efficiency = 94.0 %

Fan Mode : Continuous Fan Power 400. watts

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel : Natural Gas
Water Heating Equipment : Induced draft fan
Energy Factor : .571

Manufacturer : John Woods
Model : Superflue JW 520 PV
Tank Capacity = 33.3 Imp Gal Tank Blanket Insulation .0 R
Tank Location : Basement
Pilot Energy .0 BTU/hr Flue Diameter 3.0 In

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -23.8 F	=	2.50 BTU/hr/Ft3	= 54246. BTU/hr
Including credit for HRV	=	2.19 BTU/hr/Ft3	= 47456. BTU/hr

Gross Space Heating Load	=136.560 Mil.BTU
Usable Internal Gains	= 33.437 Mil.BTU
Usable Internal Gains Fraction	= 24.5 %
Usable Solar Gains	= 22.257 Mil.BTU
Usable Solar Gains Fraction	= 16.3 %
Auxiliary Energy Required	= 80.866 Mil.BTU
Space Heating System Load	= 80.866 Mil.BTU
Furnace/Boiler Seasonal efficiency	= 92.7 %
Furnace/Boiler Annual Energy Consumption	= 86.027 Mil.BTU

*** ANNUAL DOMESTIC WATER HEATING SUMMARY ***

Daily Hot Water Consumption	= 64.0 Imp Gal /day
Hot Water Temperature	= 120.0 F
Estimated Domestic Water Heating Load	= 20.274 Mil.BTU
PRIMARY Domestic Water Heating Energy Consumption	= 32.475 Mil.BTU
PRIMARY System Seasonal Efficiency	= 62.4 %

*** BASE LOADS SUMMARY ***

	kwh/day	Annual kWh
Interior Lighting	1.8	650.9
Appliances	4.2	1526.9
Other	5.6	2051.3
Exterior use	7.9	2877.0
HVAC fans		
HRV/Exhaust	3.7	1367.1
Space Heating	9.6	3504.0
Space Cooling	.0	.0
Total Average Electrical Load	32.8	11977.2

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	1354.7	344.1	.0
Neither	12.5	3159.9	.0
Cooling	.0	.0	.0
Total	1367.1	3504.0	.0

*** R-2000 HOME PROGRAM ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	=	92003. MJ	= 25556.3 kWh
Ventilator Electrical Consumption: Heating Hours	=	4877. MJ	= 1354.7 kWh
Estimated Annual DHW Heating Energy Consumption	=	34263. MJ	= 9517.6 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	=	131143. MJ	= 36428.5 kWh
ANNUAL R-2000 SPACE + DHW ENERGY CONSUMPTION TARGET	=	101716. MJ	= 28254.3 kWh

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel	Space Heating	Space Cooling	DHW Heating	Appliances	Total
Natural Gas (MCF)	86.0	.0	32.5	.0	118.5
Electricity (kWh)	4858.7	.0	.0	7118.6	11977.2

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

Project 4413580-38

VOCs on 3M OVM 3500 Organic Vapour Monitors

COMPOUND	Airborne Concentration (µg/m^3)	
	# 7810	# 7795
Hexane	2492.2	25.3
Dichloromethane	4.3	0.8
Benzene	4.0	11.4
n-Decane	22.1	6.4
Trichloroethylene	<0.3	<0.3
Chloroform	9.7	1.4
a-Pinene	15.6	16.7
Tetrachloroethylene	0.6	0.8
Toluene	46.3	47.0
1,2-Dichloroethane	<0.3	<0.3
Ethylbenzene	5.4	4.5
p-Xylene	5.7	4.9
m-Xylene	17.8	15.9
o-Xylene	8.0	7.3
d-Limonene	4.5	27.8
1,3,5-Trimethylbenzene	3.3	2.1
Styrene	0.8	5.8
p-Cymene	3.3	2.7
1,2,4-Trimethylbenzene	8.4	6.1
1,3-Dichlorobenzene	<0.3	<0.3
Pentachloroethane	<0.3	<0.3
Hexachloroethane	<0.3	<0.3
1,4-Dichlorobenzene	<0.3	0.4
1,1,2,2-Tetrachloroethane	<0.3	<0.3
1,2,4-Trichlorobenzene	0.6	1.2
Naphthalene	0.3	0.5
Lab Supervisor	You-Zhi Tang, Ph. D.	

Project 4413580-38
SAMPLE LOG

Sample Number	Sample Identifcation	Start Date/Time	Stop Date/Time	Exposure Duration (min)
# 7810	4725 56th St. Reno Demo	94/11/01-18:10	94/11/08-15:20	9910
# 7795	4725 56th St. Reno Demo	94/12/12-16:10	94/12/19-14:26	9976

University of Alberta
Edmonton
Canada T6G 2E1

Microfungus Collection and Herbarium
A Division of the Devonian Botanic Garden
Telephone (403) 987-4811 Fax (403) 987-4141

March 24, 1995

Mr. Will Mayhew
Howell Mayhew Engineering Inc.
15006 103 Avenue
Edmonton, AB
T5P 0N8

Dear Mr. Mayhew:

RE: FINAL REPORT
RCS samples from the private home, Red Deer, received February 24, 1995.

Collection Site	CFU/m^3	Species (% frequency occurrence)
1. Inside home	13	*Penicillium chrysogenum*.
2. Outside	144	*Eurotium amstelodami* (35%), *Eurotium repens, Aspergillus versicolor, Aspergillus candidus, Emericella nidulans, Scopulariopsis brevicaulis, Scopulariopsis brumptii, Microascus manginii, Apiospora montagnei, Ulocladium atrum, Penicillium implicatum*.

Examination of the RCS strip from air-sampling showed low numbers of fungal colony forming units (CFU's) inside the home. Guidelines adopted by the World Health Organization suggest that levels greater than 150 cfu/m^3 of mixed species or 50 cfu/m^3 of a single species are unacceptable in indoor air. The World Health Organization adopted these guidelines in 1988 based on work by Miller et al. (1988, International Biodeterioration 24: 103-120), and the guidelines have also been adopted by Alberta Health (Alberta Health, 1993, Indoor air quality. A working manual) and Health Canada (Nathanson, 1993, Indoor air quality in office buildings: a technical guide). Thus, the area sampled is well within acceptable levels for indoor air, and is considerably lower than the level seen outside.

Penicillium chrysogenum is one of the most common species of *Penicillium* in indoor environments, and its presence in relatively low levels is not unusual. It is known to produce mycotoxins, but it is not known to produce the most potent toxins.

Yours sincerely,

Lynne Sigler
Curator UAMH & Associate Professor
Medical Microbiology & Immunology

Sean P. Abbott
Assistant Mycologist

National Building Inspections

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November 7, 1994

Howell-Mayhew Engineering
Edmonton, Alberta

File No. E-94006

Dear Mr. Wil Mayhew:

Re: **60 Hertz Magnetic Field Survey**
4725 - 56 Street
Red Deer, Alberta

As requested, we conducted a 60 hertz magnetic field survey in the residence and on the appliances of the subject property on October 28 and 31, 1994.

The purpose of the survey was to provide spot measurements of the ambient 60 Hertz magnetic flux densities of various rooms and appliances in the residence. The following report details our findings.

• 4632 - 62 Street, Red Deer, Alberta, Canada T4N 6T3 Phone (403) 340-8603 Fax (403) 341-4710
• 76 Country Hill Close N.W., Calgary, Alberta, Canada T3K 3Z2 Phone (403) 295-2914 Fax (403) 295-2914

Electromagnetic Field Survey Report

A) Inspection Data (Room Survey)

Property Address: 4725 - 56 Street
Red Deer, Alberta

Inspection Date: October 28, 1994

Inspection Time: Commenced 10:30 a.m
Concluded 11:45 a.m.

Technician: Ann Dow

60 Hertz Magnetic Field Detector Used:
TRACER Micro ELF (Radiation Technology)

A single-axis instrument probe consisting of a Faraday indication coil and a detector circuit that processes the signal from the probe in units of magnetic flux density (milligauss).

Spot Magnetic Flux Readings in Milligauss
Residential Survey

Location Description	Reading @ Centre of Room	
	Power On	Power Off
Kitchen (light on)	0.78	0.21
Family Room	0.22	0.18
Dining Room	0.29	0.21
Living Room	0.33	0.27
Hallway	0.31	0.22
Hallway Upstairs	0.31	0.34
Bathroom Upstairs	0.22	0.22
1st Bedroom	0.20	0.25
Bedroom #2	0.27	0.27
Bedroom #3	0.22	0.28
Entry Way (Front)	0.25	0.28
Main Floor Bathroom	0.27	0.25
Centre of Basement	0.24	0.21

Comments:

This residence has been the Red Deer Demo 1994 Project and was unoccupied at the time of our visit; however, power was being supplied to the residence.

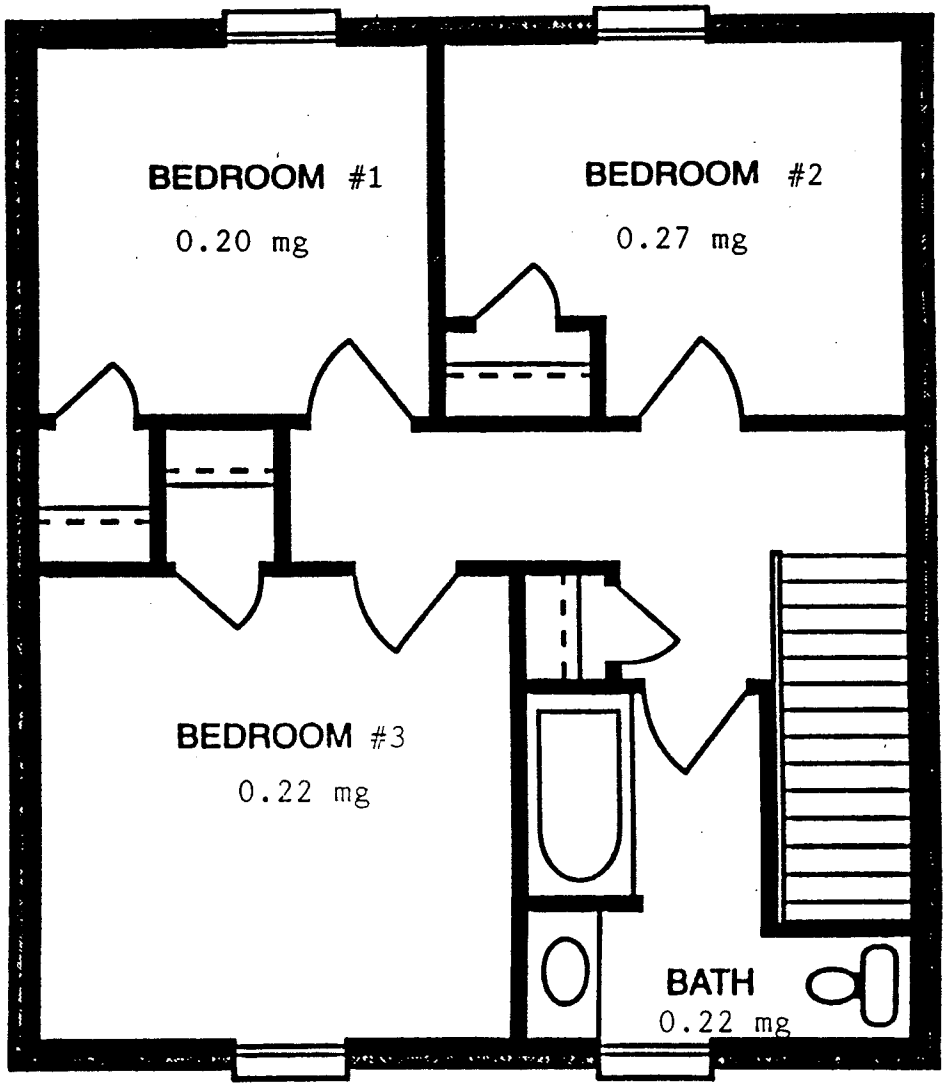
All spot readings were taken in the centre of the room at an approximate 1.3 metres from the floor surface.

A total of two spot readings were taken in each room of the residence - one reading with power on and one with power off. During the "power on" readings, the lights in each room were also turned on, with the exception of the living room. No light switch for the living room light was available. It was our understanding that this outlet is yet to be located.

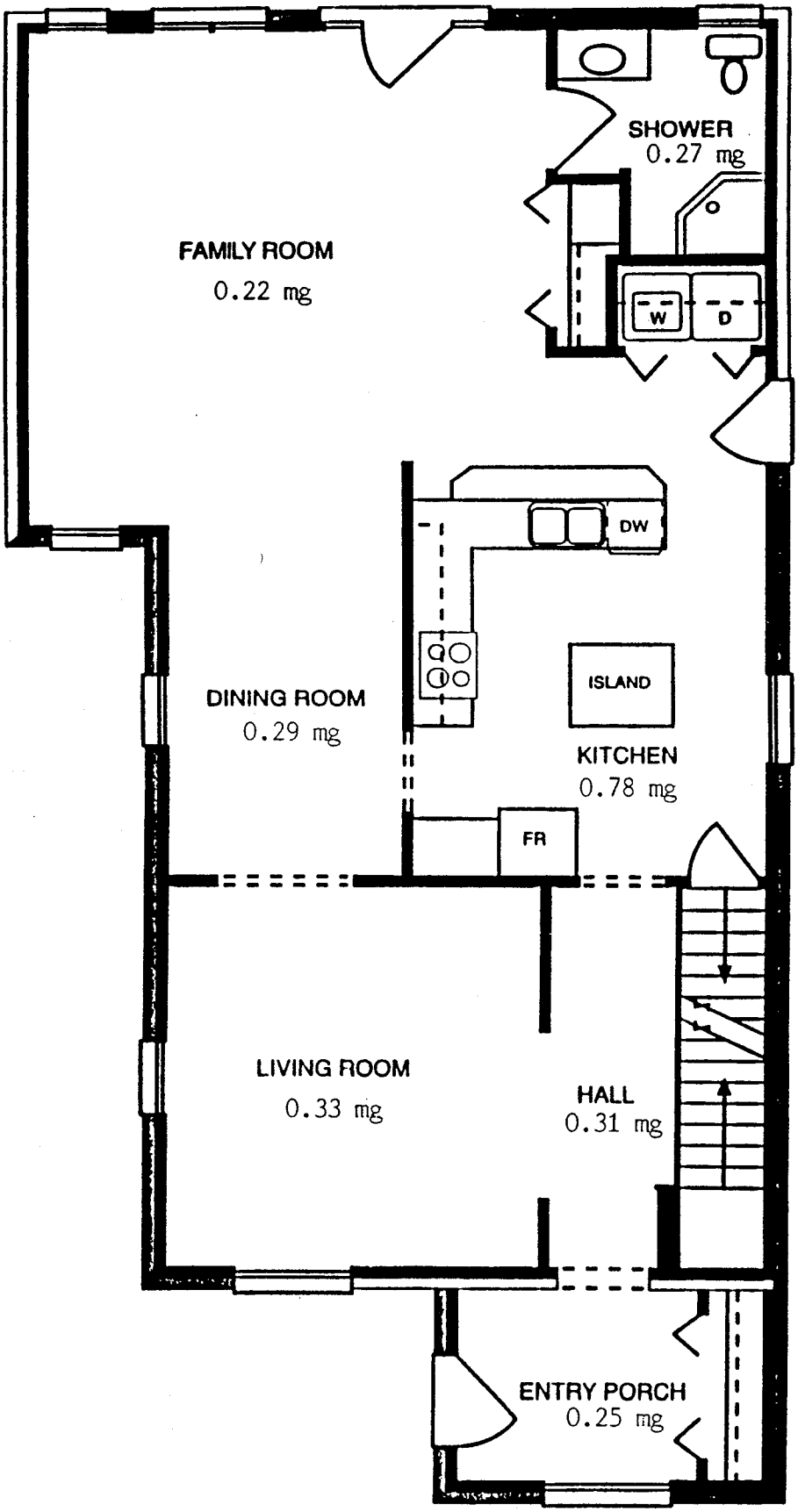
All readings in the residence, with the exception of kitchen centre (lights on) compare favorably with the Electric Power Research Institute's report of 0.35 miligauss as the median residential exposure level from power lines of their study of homes in the United States. The source affecting the elevated reading in this location is the low-hanging compact florescent light fixture. When this light was turned off (power still on) in this room, the reading at this location was .29 milligauss.

B) Diagrams of Readings by Rooms: (Power On)

Upper Floor



Main Floor


SHOWER
0.27 mg
FAMILY ROOM
0.22 mg
W
D
DW
ISLAND
DINING ROOM
0.29 mg
KITCHEN
0.78 mg
FR
LIVING ROOM
0.33 mg
HALL
0.31 mg
ENTRY PORCH
0.25 mg

C) Inspection Data - Appliance Survey

Property Address: 4725 - 56 Street
Red Deer, Alberta

Inspection Date: October 31, 1994

Inspection Time: 10:30 a.m. to 11:30 a.m.

Technician: Ann Dow

60 hertz Magnetic Field Detector Used: Tracer Micro ELF (Radiation Technology)

Appliance/Location	Field 04"	Field 12"	Under 1 milligauss
Kitchen Appliances:			
Refrigerator (compressor off)	0.18		
Refrigerator (compressor on)	5.84	2.76	25"
Stove (off)	0.12		
Stove (burners/oven on)	0.68-31	0.24-3.84	21"
Basement Appliances:			
Power Box	7.76	1.84	13"
Dynovac	27	5.00	28"
HRV (operating on low)	4.45	0.93	12"
HRV (operating on high)	6.00	1.04	13"
Induced Draft Fan (hot water)	48	5.99	22"
Lennox Furnace	32	2.84	23"

Comments:

Appliance readings were taken at a 4 inch and 12 inch distance from the appliance. The distance at which the magnetic field dropped below one milligauss was also noted.

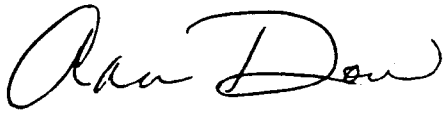
Spot readings on the refrigerator and stove were taken at the approximate centre of the appliance. Spot readings on the Dynovac, HRV, Lennox furnace and Induced Draft Fan were taken from the approximate centre of motor locations.

The dishwasher could not be measured - it appeared to be not completely wired in as yet.

Measurements taken from the stove with burners/oven on indicated rapid and significant fluctuations in the readings. Because there was difficulty in obtaining a reliable "spot" reading at this location, the range of readings over an approximate one minute period has been recorded.

This concludes the written report. If further interpretation or clarification is needed for this report, please do not hesitate to call.

Yours truly,
National Building Inspections



Ann Dow
Certified Environmental Inspector