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Northwest Residential Infiltration Survey (NORIS) Technical Reference Field Manual

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July 1988

**Prepared for
the State of Idaho
Department of Water Resources
under Contract 2311112709**

 **Battelle**
Pacific Northwest Laboratories

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**NORTHWEST RESIDENTIAL INFILTRATION SURVEY
(NORIS) TECHNICAL REFERENCE FIELD MANUAL**

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July 1988

**Prepared for
the State of Idaho
Department of Water Resources
under Contract 231112709**

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Richland, Washington 99352**

SUMMARY

This document is intended to serve as a standard technical reference manual for field specialists performing data collection for the Northwest Residential Infiltration Survey (NORIS). It is also intended as a training aid and as project documentation of data collection principles, procedures, and protocols for the field measurements portion of the project. The primary purpose of this manual is to ensure that the data collected in NORIS participant homes is meaningful and defensible, and that it is collected efficiently, with minimal disturbance to the occupants of those homes.

The procedures documented in this manual include those for acquiring data on structure leakage using a one-time fan pressurization (blower door) measurement, information on structure and occupant characteristics, a two- to three-week ventilation measurement using a perfluorocarbon tracer (PFT) technique, temperature and wind speed data, and records of significant occupant activities during the PFT measurement period.

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1.0 FIELD PROTOCOL SUMMARY

READ

READ

READ

READ

READ

FIELD PROTOCOL SUMMARY

1. Review the material in the booklet for each home assigned. Read carefully the *SUGGESTED PFT ZONES*. Call Battelle with any immediate questions (509) 375-3799.
2. Schedule the blower door test with the homeowner. Remind them not to burn wood the day of the test. Call the homeowner if you are going to be late. Give them a phone number so you can be reached with a message if they must cancel.
3. On the test day, call the weather station and get station pressure data. Record this data in residence Booklet.
4. Bring the PFT sources, temperature recorder and "demonstration" sample tube and holder in the home with you immediately in your pocket. Leave the RATS (glass tubes) in the auto under the hood or in pickup bed.
5. Show the homeowner your *LETTER OF INTRODUCTION*. Tell them what you are going to do and how long it will take.
6. Complete the *HOMEOWNER SURVEY*. Perform the *WALKTHROUGH SURVEY*. Note the PFT zones and discuss placement of PFT sources with homeowner during Walkthrough Survey. Take temperature in each zone. Carefully complete the *STRUCTURE MEASUREMENT AND SKETCHES* and at the same time securely place the PFT sources with putty and place (optional) temperature recorder. Note these placements on the *STRUCTURE MEASUREMENT AND SKETCHES*.
7. RETURN UNUSED PFT SOURCES TO CAB OF AUTO.
8. Record the on-site *METEOROLOGICAL DATA AND EXTERIOR BUILDING PARAMETERS*.
9. Take two photographs of the outside of the home. Note House ID# on back of photos and place in Booklet.
10. Take out blower door equipment. Perform the blower door test. Record data on *BLOWER DOOR TEST* form. Place blower door calculations tape in Booklet.
11. Return blower door equipment to auto. Take out correct number of RATS (glass tubes) for the home from hood or bed of auto.
12. Hang the RATS, uncap the tubes, note ID# on *PFT DATA SHEET*. Complete the *PFT DATA SHEET* now. Complete your portion of the PFT SHORT FORM.
13. Demonstrate recovery and mailing instructions with homeowner for RATS and temperature sensor. Discuss completing the *SHORT FORM* and the *OCCUPANT ACTIVITIES RECORD*. Leave the *INSTRUCTIONS FOR THE RESIDENT* with the resident along with mailers containing spare red caps. Emphasize that the PFT Sources will be collected later.
14. Clean up any debris and thank occupants.
15. Complete and include all information in Booklet. Remove your copies (the back) of the NCR forms and mail Booklet to Battelle immediately.

TECHNICAL REFERENCE MANUAL

INTRODUCTION

This manual is intended to serve as a standard reference manual for field specialists performing data collection for the Northwest Residential Infiltration Survey (NORIS). It is also intended to serve as a training aid and as documentation of data collection procedures. Data sheets and forms to be used in the field have been designed to be largely self-prompting so that constant reference to the manual by an experienced field specialist should not be unnecessary once experienced in the field procedures. We have included completed forms in this manual as examples to be followed.

RESIDENT RELATIONS/SITE DECORUM

The success of this monitoring effort relies upon resident cooperation. They are all volunteers. Field specialist appearance, behavior, and attitude should reflect professionalism. The following guidelines are important.

- Your appearance should be clean and neat. New jeans and dress shirt or sport shirt are appropriate attire. Wear sneakers or comfortable dress shoes. Because this study involves only testing, dress clothing will not be subject to damage from sealants or dirt. Keep blower doors and vehicles clean, too.
- Do not smoke, eat, or drink in the home. Tests will normally be performed two per day which will allow a lunch break between sites.
- Avoid using the homeowner's phone or bathroom. These activities should be scheduled before arriving at the home or on lunch break.
- Stay at the site until testing is complete.
- Keep equipment (and feet) off the furniture.
- Do not leave a company business card with the resident. As our contractor, you are representing Battelle, not your company. Any additional questions that the resident may have should be directed to our office.
- Avoid discussing results of the testing unless asked. The homeowner will receive results after PFT materials are returned and analyzed. (Some blower door calculators may use a slightly modified version of the LBL model - we want to avoid having different numbers reported by you and Battelle.) If a resident is very curious about infiltration, you may tell them blower door test results, but stress that these are preliminary.
- Do not discuss indoor air quality problems or make any suggestions as this may cause a change in occupant behavior during the PFT test.
- Do not discuss infiltration sealing or radon mitigation. NORIS should not be used as a lead in to perform other work while the study is underway. However, Battelle will refer the resident to you if the resident has a need for services that can be provided by you after the study in their home is completed.

SCHEDULING

You will receive a list of homes to be tested along with the booklets to be completed for each home from Battelle. The list will contain names, addresses, and telephone numbers (work and home if possible). The scheduling of date and time for testing will be up to you, within the dates specified by Battelle. You need to be aware that many residents will be taking off from work to be present during the blower door test, and therefore, you must be prompt. Also:

- Before leaving for a major trip to a remote area, spend a day or evening at the office phoning all the residents to preliminarily schedule your trip. This way they know approximately when to expect your later call to schedule a specific appointment. You can also find out about hard-to-reach or uncooperative parties, and other unusual situations.
- Schedule tests 2-3 days in advance, if possible. In addition, call each resident the day or evening before the visit to confirm the appointment.
- Scheduling calls should not be made before 8:00 am or after 9:00 pm unless you have been unable to make contact after multiple efforts.
- When scheduling an appointment, be sure to get accurate directions to the home. Also, tell the resident how long you expect the visit to last. Give them a phone number so you can be reached with a message if they must cancel.

AT THE HOME

When you arrive, identify yourself as the Field Specialist and offer identification with the *Battelle Letter of Introduction*.

- After arriving, quickly review with the resident the work you will be doing. Also discuss any procedures requiring homeowner input, such as PFT placements, HVAC system location and controls, structure questions, and phone/address verification. This is particularly important if the resident cannot be present during all the work. It is important, however, that the resident be present when you explain PFT recovery/mailling requirements.
- It is suggested that on-site tasks be performed in the order they appear in the *Field Protocol Summary* found on the last page of this section of the *Manual*. It may be necessary to change this order to cope with darkness, windy conditions, resident availability, or other constraints.
- One factor which is inevitable in dealing with residents, is that it takes time. A talkative, enthused, or curious homeowner can be distracting while you are trying to get your job done. A little time spent talking in such situations is worthwhile in terms of goodwill. However, it is sometimes hard to break off. A good way to do this without seeming rude is to mention that you have an appointment with another homeowner to keep. If there are non-urgent questions you cannot deal with due to time constraints, point out the Battelle (collect) phone number to the resident and have them give us a call.

ADMINISTRATIVE DETAILS

A few things you should pay careful attention to are:

- Owner-occupied homes--make sure the name, address, and phone numbers we have are complete

and correct. If mailing address is different from house address (i.e., a post office box), make sure you note this.

- Renter-occupied homes--verify name, address, and phone number, as above, for both renter and owner. (There are very few renters.)
- Handout materials--these are left with the resident and these include:
 - Mailer containing spare red caps and charcoal disk.
 - *Short Form* with your part completed.
 - *Instructions For the Resident* (carefully explained),
 - *Occupant Activities Record* (4)

Before leaving a site, be sure that you complete the *Checklist* in the back of the resident Booklet before driving away.

2.0 PFT SOURCES, SAMPLERS, AND TEMPERATURE
RECORDER PLACEMENT PROCEDURES

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PFT SOURCES, SAMPLERS, AND TEMPERATURE RECORDER PLACEMENT PROCEDURES

PURPOSE OF THIS SECTION

This section gives guidelines for placing PFT sources (colored metal capsules), locating RATS (glass tubes) in the home, documenting their placement, and obtaining related data.

Tools, Materials, and Equipment Required

- Color-coded PFT sources and poster putty.
- RATS (glass tubes), foam holders and push pins.
- *Structure Measurement and Sketches, PFT Data Sheet, Short Form.*
- Temperature Recorder (optional).
- Thermometer

PRINCIPLES

(A condensed version of these principles is given in next section in the *Manual*).

PFT SOURCES, SAMPLERS (RATS), AND TEMPERATURE RECORDERS.

Discussion--The PFT air infiltration measurement system consists of two main components-- "sources" and "samplers". The sources emit PFT, the samplers capture PFT. Hereinafter, the PFT metal sources capsules containing PFT will be known as "sources" and the glass sample tubes used to capture the PFT vapor (tracer) will be known as "RATS" (Red Adsorption Tube Samplers). The RATS are 1/4 inch diameter glass tubes packed with carbon-based absorbent. They are numbered on one end (4-digit) and capped with a red cap (with collar) on this numbered end and a black cap on the other end. The metal sources are also approximately 1/4 inch diameter, solid on one end with a rubber plug on the other end. They contain a small volume of liquid PFT of a unique chemical compound that diffuses through the plug at a known rate at a given temperature.

The sources are provided to you in metal cans. The RATS are supplied in special plastic holders. **NEVER STORE RATS AND SOURCES IN THE SAME BUILDING OR SPACE.**

The sources, stored by Type Number in the can, should be transported in the warm area of your vehicle and carried into the motel at night. Do not mix different source types (colors) in the same can.

Information about the heating system(s) and architecture of the homes to be monitored in this study will be obtained from the telephone survey. This information is important for estimating the number of air flow zones in the home and, therefore, the type and number of PFT sources and RATS to be deployed in each home. This is done by Battelle prior to assigning a home to you to guide you toward making the final decision about source and sample tube placement. Though Battelle will suggest the PFT source and RATS configuration in each home in the study based on this information, the final placement of the sources and RATS is up to you in consultation with the homeowner.

ZONING

Every home in the study will be monitored for air exchange rate using PFT in a minimum 2-zone configuration. This will require two different types of PFT sources in each home. A maximum of three different types of PFT sources will be deployed in this study, correspondingly limiting the number of zones to be studied in any home to three.

The following principles apply to determining the zones in a home.

- Each level of a home is a zone unless there is free air circulation with another level (e.g., lofts).
- A zone can contain several individual rooms and can generally be defined by "use" area of a home (e.g. sleeping).
- An attached garage, carport, or crawlspace (vented or unvented) are not considered zones and neither sources nor RATS are placed in these areas.
- All single level homes will be a minimum of 2-zones with very large (> 3000 ft²) single story homes 3-zones.
- The bedroom (sleeping) area of a home is usually considered a single zone.
- All basements, including "daylight" basements (conditioned or not) are considered a single zone.
- A two-level home is a 3-zone home
- A two-level home with a basement is a 3-zone home (with the basement a single zone).

Zones will be identified on the *Structure Measurement and Sketches* and described on the *PFT Data Sheet* according to the following convention:

- "Basement" zone (fully below grade)
- "Ground Floor" zone (includes daylight basement)
- "1st Floor" zone (1st floor above ground floor)
- "2nd Floor" zone (2nd floor above ground floor)

SOURCE DEPLOYMENT

The three types of PFT sources we will use in this study are designated as follows:

Type Number	Capsule Color	Compound
2	Red	PMCH
4	Blue	o-PDCH
5	Black	p-PDCH

One source type is deployed in each zone. Because it is important to ensure that the PFT is well-mixed in the home in each zone, the following deployment strategy should be followed.

- A minimum of one source (capsule) will be placed in every zone in every room greater than 80 ft² that has a door, even if the room is closed off.
- One source will be placed every 500 ft² in large rooms (areas) of zoned-heated homes.
- One source will be placed every 750 ft² in large rooms (areas) of centrally-heated homes.

Each source type exhibits a different mass emission rate from the capsules, and therefore, they must be deployed according to their emission rate. It is necessary to place the source type with the highest emission rate in the highest zone of the home to insure that sufficient tracer migrates to, and is detected in, the lowest zone of the home. Therefore, the following principles shall be followed for choosing the source type for each zone. Generic house diagrams are provided in the next section of the *Manual* to illustrate these principles. Please review them carefully.

- All basements and ground floors will have Type 5 (black) sources.
- A one-level home without a basement that is 2-zone will have Type 2 (red) and Type 4 (blue) sources in the ground floor. (See Figure 1, next section.)
- A two-level home without a basement will have Type 2 (red) sources in the 1st floor above the ground floor and both Type 4 (blue) and Type 5 (black) sources in the ground floor. (See Figure 2, next section.)
- A one-level home with a basement will have Type 5 (black) sources in the basement and Type 2 (red) sources and Type 4 (blue) sources in the ground floor. (See Figure 3, next section.)
- A home with a daylight basement with two levels above the daylight basement will have Type 5 (black) sources in the daylight basement, Type 4 (blue) sources in the 1st floor and Type 2 (red) sources in the 2nd floor. (See Figure 4, next section.)
- A home with one level above the ground floor and with a basement will have type 5 (black) sources in the basement, Type 4 (blue) sources ground floor and Type 2 (red) sources in the 1st floor (above ground floor). (See Figure 5, next section.)

SOURCE LOCATIONS

The sources should be placed near an exterior wall in the extremities of the zone. This is to insure that the source is carried into the room or zone by the air that is normally infiltrating into the home from exterior wall areas. The sources should be placed no less than approximately two feet from the floor. You and the resident must agree on source locations.

Good locations for sources are on objects that are not easily moved including: shelves, picture frames, door frames, cabinet tops, plants (not buried, however), counter tops, and large furniture (legs, under the tables and ledges). The sources should be hidden if possible and secured with poster putty to keep them from rolling or falling on the floor where they could be picked up and swallowed by children, kicked around, or vacuumed.

The sources should be placed no closer than 3-5 feet from items that emit heat or ventilation air. These include: any vent/grill (including window air conditioners), window (whether it opens or not), exterior/garage/basement

door, wood stove/fireplace, refrigerator/freezer/microwave and not above a baseboard/wall heater or lamp. The sources should also not be placed in the direct or indirect sun or less than five feet from a stairwell (bottom or top) that separates zones.

RATS DEPLOYMENT

An average of 5 RATS will be deployed in each home. Generally, the larger the home, the greater the number of RATS used. In some homes, we will deploy one or two additional RATS but not uncap them to examine leakiness of the caps. In a few selected homes, we will deploy RATS in replicate pairs. You will be informed of these special cases on the *Suggested PFT Zones* form (see "Forms" section)

The following RATS deployment strategy applies to all homes in the study.

- A minimum of one RATS will be placed in each zone.
- Approximately two RATS will be placed in large zones (>500 ft²) spacially separated.
- Approximately 2-3 RATS will be placed in the bedroom zone, one each in two rooms (one room likely the master bedroom).
- No RATS will be placed in rooms that are closed off during the day. (RATS are, however, placed in basements even if they are closed off during the day--see first deployment principle above.)

In your deployment, you also need to consider the ability of the resident to easily recover the RATS when it is time for them to cap and mail.

RATS LOCATIONS

RATS are placed in a foam holder, open-end down, and hung from the ceiling using a tack punched through the string that is glued to the holder. Each foam holder is capable of holding 2 RATS. You normally use just one RATS in each holder.

The following guidelines are to be followed for locating the RATS in the homes. The final decision on RATS locations is up to you in agreement with the resident.

- RATS should not be placed near (< 5ft) any PFT source capsule.
- RATS should be hung in a central part of the zone.
- RATS should be hung at least eight inches from the wall, slightly above head height, and no closer than five feet from a vent/grill, window, or exterior door.
- No RATS should be placed near a stairwell (bottom or top) that separates zones.

TEMPERATURE RECORDERS

You will be given several credit-card-sized battery-operated temperature recorders to be used in homes to record time-series temperature data during the time of the PFT test. The emission rate of the PFT sources is temperature dependent, and therefore, it is important to know (record) the average temperature in zones of homes that will experience wide diurnal fluctuations in temperature during the time of the PFT test.

TEMPERATURE RECORDER DEPLOYMENT

Only a limited number recorders are available for the study, and therefore, recorders cannot be placed in all homes. The recorders can be reused and will be returned to you for reuse once the data from a home is extracted from the recorder. Because there are a limited number of recorders, the following principles apply for temperature recorder deployment.

- Generally only one recorder should be deployed in a home.
- The recorder should be placed in a zone of a home that experiences the greatest range of diurnal temperatures. These include zones that are heated with wood (especially if the wood stove is allowed to die out overnight), and homes that have a central HVAC system and the residents use the setback feature on the thermostat. (Note that heat pump homes will not normally use the setback feature.)

TEMPERATURE RECORDER LOCATIONS

All the recorders are equipped with magnetic strips on the back, and can therefore, be mounted on magnetic surfaces. In most cases this will not be possible and other "secure" locations must be found. The poster putty supplied for the sources can be used to securely mount the recorder. The following guidelines apply:

- Locate near (< 5ft) the source in that zone if only one source capsule is used. If more than one source capsule is used in the zone, locate in a central area of the zone.
- Place the recorder in any position, but at the same elevation as the source(s).
- Secure the recorder and place away from children and pets.
- Do not place the source on the recorder. We do not want the resident to mail the source with the recorder.
- Place the recorder on or near the set-back thermostat if locating in the zone with the thermostat.

DEPLOYMENT TACTICS FOR SOURCES, RATS AND TEMPERATURE RECORDERS

You will be supplied sufficient number of sources, RATS, holders, forms and mailers for the homes prior to entering the field. During transport in a vehicle, the sources should be kept in the passenger compartment and the RATS kept in the pickup bed, but never in the trunk or in the back end of a van. If you have a car or van with air conditioning, you should consider transporting the RATS outside the vehicle, rather than under the hood because of possible contamination from the freon in the air conditioner.

SOURCE PLACEMENT

You should bring (in your pocket) several sources of each type into the home immediately upon arrival at the home. The sources are placed (according to the principles above) in the appropriate locations during the completion of the *Structure Measurement and Sketches* form (See "Forms" Section). You will record the location of each source in each zone with an "S" followed by the Type number circled on the *Structure Measurement and Sketches* form. Locations of each source and type will also be recorded on the *PFT Data Sheet* (See

Figures and "Forms" Sections). The room temperature of each room or area with a source is also to be recorded with the "S" on the *Structure Measurement and Sketches* form. The zone temperature is an average of the source temperature in that zone.

Sources are returned to your vehicle prior to performing the blower door test.

TEMPERATURE RECORDER PLACEMENT

You will place the temperature recorder (if needed) at the same time that the sources are deployed. Turn on the recorder by brushing the slot in the back with a key or coin. Record the location with a "T" inside a circle on the *Structure Measurement and Sketches* form. Record the ID number (found in the back of the recorder) and location of the recorder in the appropriate Zone on the *PFT Data Sheet*.

RATS PLACEMENT

The RATS should be brought into the home after the blower door test is completed. The RATS will be placed in the zones according the strategy given above. You will record the location of each RATS on the *Structure Measurement and Sketches* form with an "R" followed by an arbitrarily assigned number and circled. This "R" number is also written on the *Short Form* left with resident. (This single digit "R" number chosen by you and is independent from 4-digit the ID number etched on each RATS).

Record the 4-digit RATS ID number and location for each zone on the *PFT Data Sheet*.

Uncap each RATS at one end (the numbered end with red cap and sleeve) at the time of deployment. Push the red cap a short distance up the tube to clear the cap end from the end of the tube. Record the date and time of uncapping on the *PFT Data Sheet*. Since all the RATS are normally uncapped within one-half hour of one another, only one uncap time needs to be recorded for all the RATS on the *PFT Data Sheet*. This same uncap date and time is to be immediately recorded on the *Short Form* that is left with the resident.

The uncapped RATS are left in the home for 2-4 weeks. At the end of this time period, Battelle will contact the resident by telephone and request that the RATS be taken down, capped and mailed to Battelle in the mailer left by the field specialist.

3.0 BLOWER DOOR TEST PROTOCOL

THE HISTORY OF THE UNITED STATES OF AMERICA

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BLOWER DOOR TEST PROTOCOL

This part of the manual describes the protocol to be used in conducting fan pressurization (blower door) tests for the NORIS Project. The procedures to be used in the project are based on the American Society for Testing and Materials (ASTM) Standard Test Method E779-87 Determining Air Leakage Rate by Fan Pressurization. Please read this standard (ASTM). Salient features of the Standard that are of particular importance for you to note include:

- * The acceptable test apparatus and the required accuracy of instrumentation (Section 6).
- * The preferred meteorological conditions, indicating wind speed not greater than 4 mph and ambient temperature not less than 35 °F (Sections 8 & 12).
- * The procedures for preparation of the building envelope and HVAC system. Interconnecting doors will be open and closet doors closed. HVAC dampers and registers will not be adjusted. Fireplace dampers will be closed but not sealed. Exhaust fans will likewise not be sealed unless they have a functioning damper (see #17 below).
- * A definition of the building volume that is included in the calculation of air change rate. Interior volume is defined as conditioned space, excluding attics and garages, unless the spaces are connected to the heating and air conditioning system (Sections 3 & 4).
- * The equations for the calculation of leakage area (Section 9). The assumed reference pressure for Effective Leakage Area (ELA) calculation is 4 Pa. This calculation will be performed by Battelle using blower door raw data.

EXCEPTIONS, MODIFICATIONS AND IMPORTANT POINTS

You should be aware of certain deviations from ASTM E779-87. These are recommended due to the number of homes to be tested and the inclusion of PFT measurements in this study. Generally requirements will be as stringent as those in the Standard. Some additional modification may be recommended after the study is underway. We will advise you. Exceptions or extensions to ASTM E779-87 for this study are:

1. Only blower doors manufactured by a recognized, reputable manufacturer will be allowed. All blower doors used will be of the orifice flow measurement type; no RPM type blower doors will be used.
2. You may conduct blower door tests under other than the preferred wind and temperature conditions. You should avoid driving to the home on windy days, but once at the site, perform the blower door test and deploy PFT materials regardless of weather conditions. On-site wind speed and temperature will be recorded on the *Blower Door Test* form. Battelle will determine if a second fan test will be required. The second test will be performed at the time of PFT test recovery and the more accurate test data will be entered into the data base. We will aid you in determining the date of the second test.
3. On extremely cold days, you may not be able to perform a pressurization test because of the amount of cold air brought into the home. Use your best judgement.

4. All raw data will be kept in the data base and the calculation of the values of "C" and "n" will be performed independently by Battelle. The ELA will likewise be calculated by Battelle. You will, however, be requested to include a copy of your paper tape (calculations) in the Booklet.
5. All flow data will be retained and corrected by Battelle using on-site temperature and uncorrected station pressure data. Therefore, it is important that we know the barometric pressure you used in your program when you conducted the test and performed your calculations. Battelle will determine the actual station pressure for the day of the testing from other sources of information. If possible you should use a default pressure setting of 29.921 inches for all fan tests regardless of the station elevation. Battelle will make the appropriate corrections later.
6. The indoor temperature used to calculate air density for the test will be the average of the temperatures you will measure in each house (PFT) zone. These temperatures, as well as outdoor temperature and wind speed, are determined once, before flow and pressure data are taken. (Relative humidity and wind direction will not be measured as they are not required in any calculation.)
7. Test accuracy will be based on the correlation coefficient. A correlation coefficient of 0.998 or higher will be sought as determined from your on-site program analysis results. If not attained, you should repeat the test. No more than 2 tests should be conducted.
8. Target test pressures will range logarithmically from 15 Pa to 60 Pa (0.06-0.24 in) rather than 12.5 to 75 Pa as recommended by ASTM. The target pressures in the range are only guidelines; you should record the actual pressures attained at the time of the test(s). A minimum of 8 flow data points should be taken.
9. Both depressurization and pressurization tests are to be performed on each home. However, on rare occasions, you may find it impossible to perform a depressurization test due to the risk of entraining wood ashes into the home. Use wet or dry newspapers to cover the ashes if possible.
10. You will be testing duct work leakage in selected homes with centrally-ducted systems. This is done during the depressurization test only. After completing the initial depressurization test, tape, or otherwise seal, all ductwork and perform the depressurization test once again. Record these pressure and flows on the second page of the *Blower Door Test* form. It may be impossible to seal all ducts in some homes because of duct locations or other structural/occupant barriers. If this is the case, do not attempt to perform the test with the HVAC ducts sealed in this home.
11. Be sure to turn off the central heating system when performing the blower door test.
12. The garage door should be left in the position it is normally placed by the resident during the heating season (this is likely normally closed.)
13. Because of the time and cost limitations, it is not possible to use a smokestick to determine the leakage distribution in the structure between the floor, wall and ceiling. Instead, just write down the 4-5 greatest leakage locations in the home on the *Blower Door Test* form based on your best professional judgement. We will assign leakage values for the modeling.
14. The test report should not include all of the information listed in Section 10 of the Standard.

15. You need to estimate the Local Shielding and Local Terrain coefficients to the best of your ability based on the descriptions given in the table at the bottom of the *Meteorological Data and Exterior Building Parameter* form. These are critical to the LBL model, so pay careful attention to this detail.
16. The natural pressure differential across the building envelope should be measured before beginning the fan testing. Do not zero your gages. Record the offset (P) on the appropriate space in the *Blower Door Test* form.
17. Before beginning the fan tests, it is necessary to check for functioning vent dampers. Depressurize the house to approximately 50 Pa, and check all vents for leakage. All tight vents should be sealed. Record on the *Blower Door Test* form the number of vents sealed. Use your best judgement as to whether a damper is present, functioning, and tight or not.

REFERENCE

ASTM. Annual. Standard Test Method for "Determining Air Leakage Rate by Fan Pressurization", E 779-87. Annual Book of ASTM Standards, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

4.0 SUMMARY OF PRINCIPLES

PRINCIPLES FOR PFT SOURCE PLACEMENT (Colored Aluminum Capsules)

3 Types Available for Study - One Type Color per Zone

Type 2 - Red

Type 4 - Blue

Type 5 - Black

ZONES

- Zones can be described principally by use pattern (e.g. bedrooms, kitchen, family, basement area).
- Each level of a home is a zone unless there is free air circulation with another level (e.g. lofts).
- Maximum of 3 zones in any home.
- Minimum of 2 zones in any home.
- Zones are defined/described as shown in Figures in this section. The zones are defined as follows:
 - Basement zone (fully below grade)
 - Ground Floor zone (including daylight basement)
 - 1st Floor zone (1st floor above ground floor)
 - 2nd Floor zone (2nd floor above ground floor)

PRINCIPLES FOR PFT SOURCE PLACEMENT

Number of Sources

- **1 source in every room >80 ft² that has a door (even if closed off).**
- **1 source approximately every 500 ft² in large areas of zoned-heated homes.**
- **1 source approximately every 750 ft² in large areas of centrally-heated homes.**

PRINCIPLES FOR PFT SOURCE PLACEMENT IN ZONES

- Attached garage, carport, and crawlspace are not zones.
- All basements are a single zone (including "daylight").
- A one-level home without basement is a 2-zone home.
 - Use Type 2 (red) and Type 4 (blue).
- A two-level home without basement is a 3-zone home.
 - Use Type 2 (red) in 1st floor above ground floor.
 - Use Type 4 (blue) and Type 5 (black) in ground floor.
- A one-level home with a basement is a 3-zone home.
 - Use Type 2 (red) and Type 4 (blue) in ground floor.
 - Use Type 5 (black) in basement.
- A home with daylight basement with two levels above it is a 3-zone home.
 - Use Type 2 (red) in 2nd floor.
 - Use Type 4 (blue) in 1st floor above ground floor (daylight basement).
 - Use Type 5 (black) in ground floor (daylight basement).
- A home with one level above the ground floor with a basement is a 3-zone home.
 - Use Type 2 (red) in 1st floor above ground floor.
 - Use Type 4 (blue) in ground floor.
 - Use Type 5 (black) in basement.

PRINCIPLES FOR PFT SOURCE PLACEMENT

LOCATION

Record Location in Zone on Structure Measurement and Sketches

(S2)

(S4)

(S5)

- Near exterior wall in extremities of zone, rubber plug points toward room, secure with putty.
Good locations are:
 - shelves
 - door jams
 - cabinet tops
 - counter tops (ledges)
 - pictures
 - plants
 - large furniture (legs)
- Not in direct or indirect sun.
- No less than 2 feet from floor.
- No closer than 3-5 feet from:
 - vent/grill (including air conditioner).
 - window (whether it opens or not).
 - exterior/garage/basement door.
 - wood stove/fireplace.
 - refrigerator/freezer/microwave.
 - ceiling if room has ceiling heat.
- Not above baseboard/wall heaters/lamps.
- Not on easily moveable furniture.

PRINCIPLES FOR PFT GLASS (RATS) TUBE PLACEMENT

4.5

- Average 5 RATS/home
- Minimum 1 RAT in each zone.
- Approximately 2 RATS in large (>500 ft²) zone spatially separated.
- 2-3 RATS in bedroom zone, 1 in each of two rooms (1 room probably master bedroom).
- No RATS in closed-off rooms (except basement if entire basement "room" is closed).

PRINCIPLES FOR PFT GLASS TUBE (RATS) PLACEMENT

LOCATION

Assign a Number and Record Location in Zone on Structure Measurement and Sketches



- **One RATS/holder unless otherwise instructed by Battelle.**
- **Holder hung from ceiling using push pins through string.**
- **Take into consideration resident's ability to easily recover.**
- **Central area of zone - distributed.**
- **Agreed upon with resident.**
- **No closer than 5 feet from:**
 - a source
 - vent/grill
 - window
 - exterior door
- **Away from wall (>8 inches)**
- **Not near stairwell (bottom or top) that separates zones.**

PRINCIPLES FOR TEMPERATURE RECORDER PLACEMENT

- **Records time series temperature - used to adjust PFT source emission rate.**
- **Limited number available, but will be reused.**
- **Generally used in non heat-pump centrally heated or wood-heated homes.**
- **Placed in a zone of home that will experience greatest range of daily temperature.**
 - set-back thermostat zone
 - wood heated basements/zones

PRINCIPLES FOR TEMPERATURE RECORDER PLACEMENT

LOCATION

Record Location in Zone on Structure Measurement and Sketches



- **Near source (within 5 feet) or in central part of zone with more than one source.**
- **On or near the set-back thermostat if locating in that zone.**
- **Any position - but same general elevation as source.**
- **Away from children/pets.**
- **Secure using magnetic back and/or putty.**
- **Turn on when deploying.**

APPENDIX A

TYPICAL PFT PLACEMENT STRATEGIES IN HOMES

Page 10 of 10

A.1

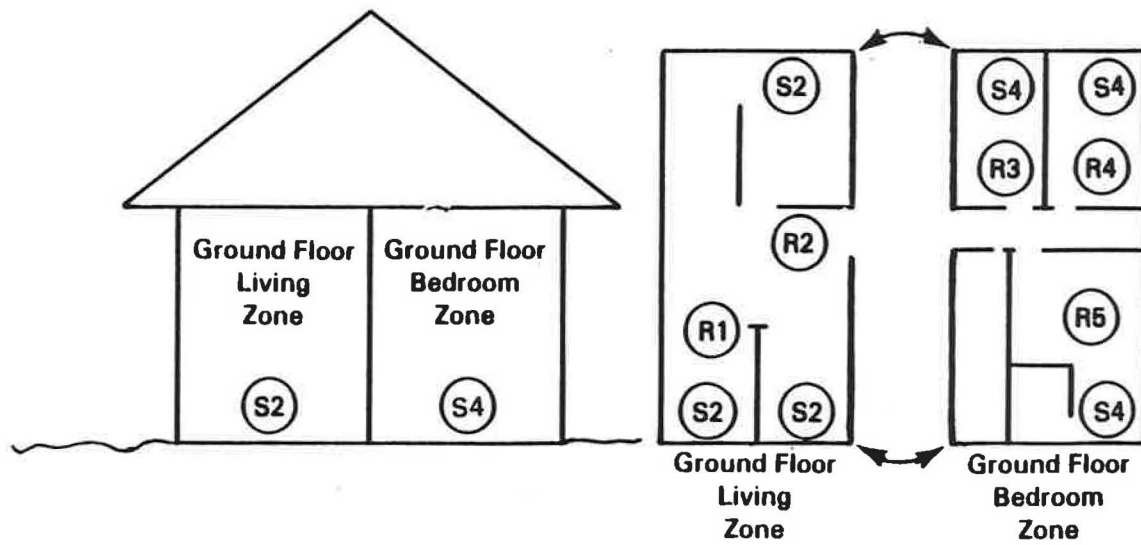


FIGURE A.1. PFT Placement Scheme for a One-Level Home Without a Basement

A.2

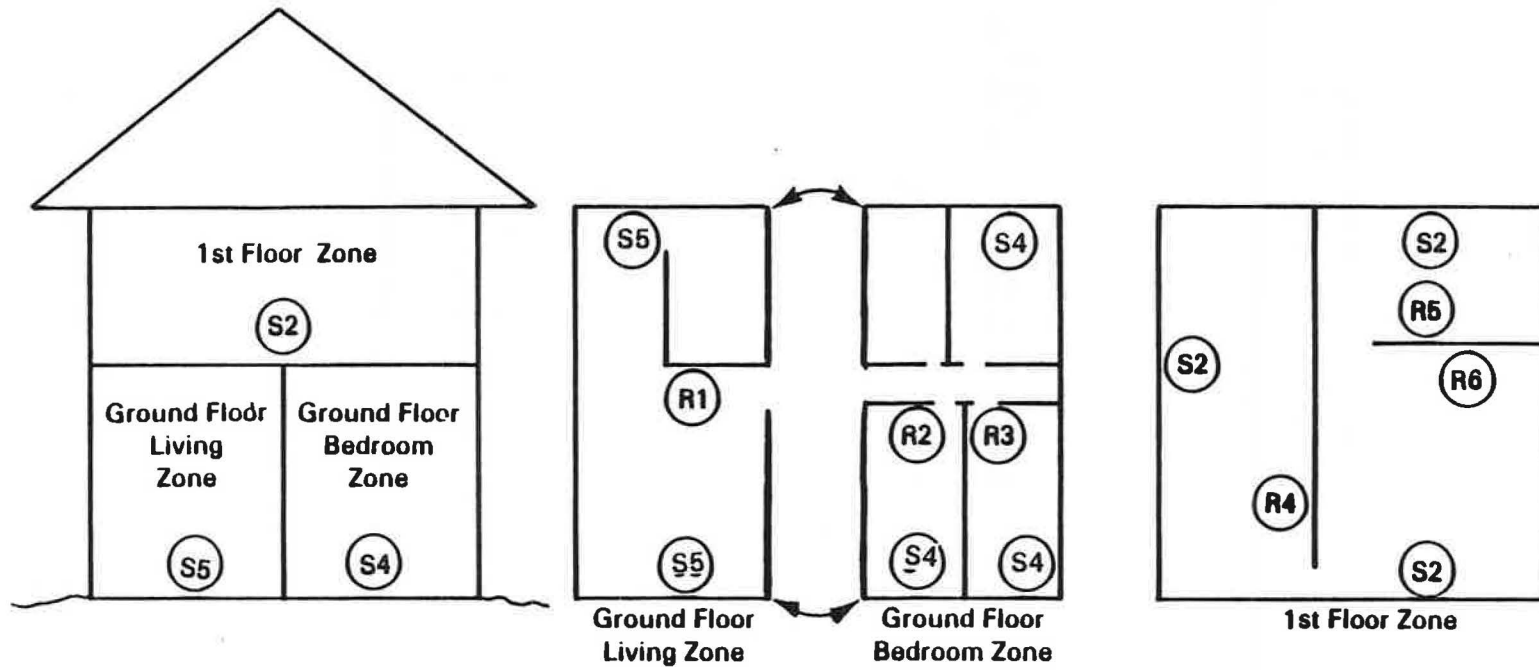


FIGURE A.2. PFT Placement Scheme for a Two-Level Home Without a Basement

A.3

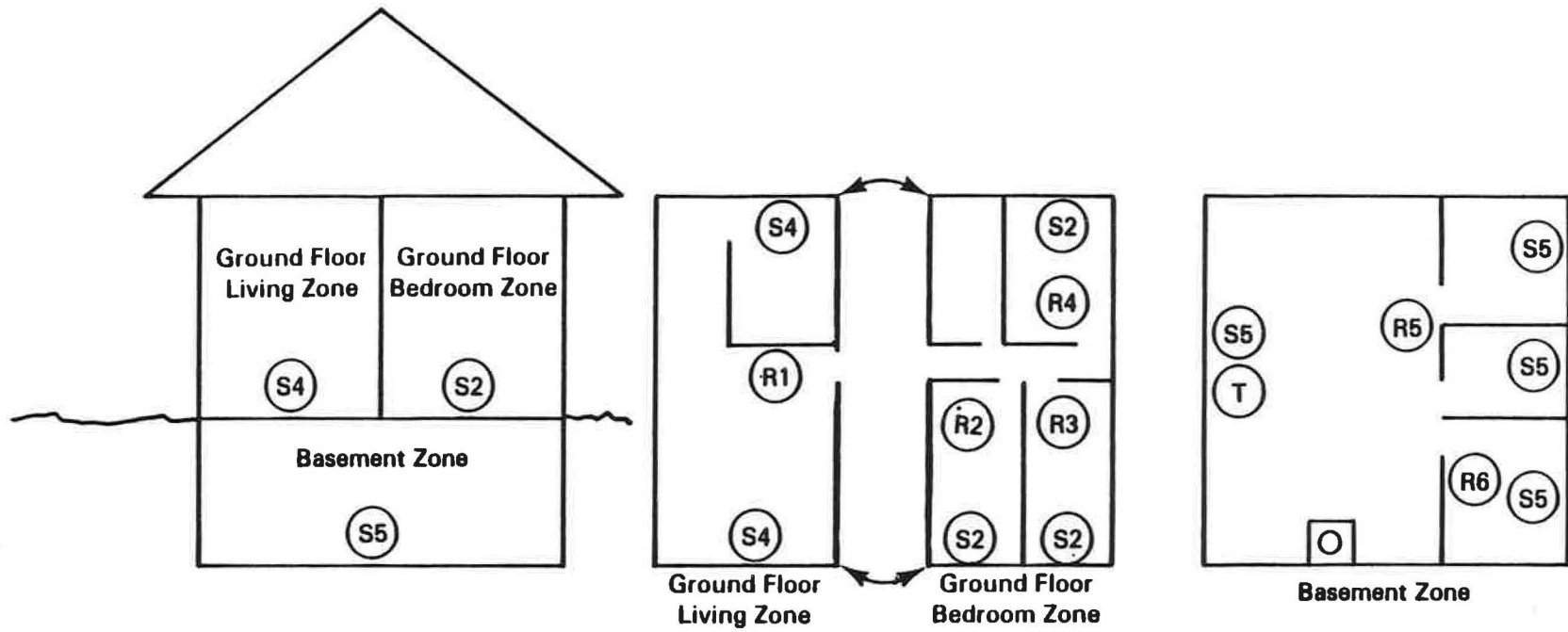


FIGURE A.3. PFT Placement Scheme for a One-Level with a Basement

A.4

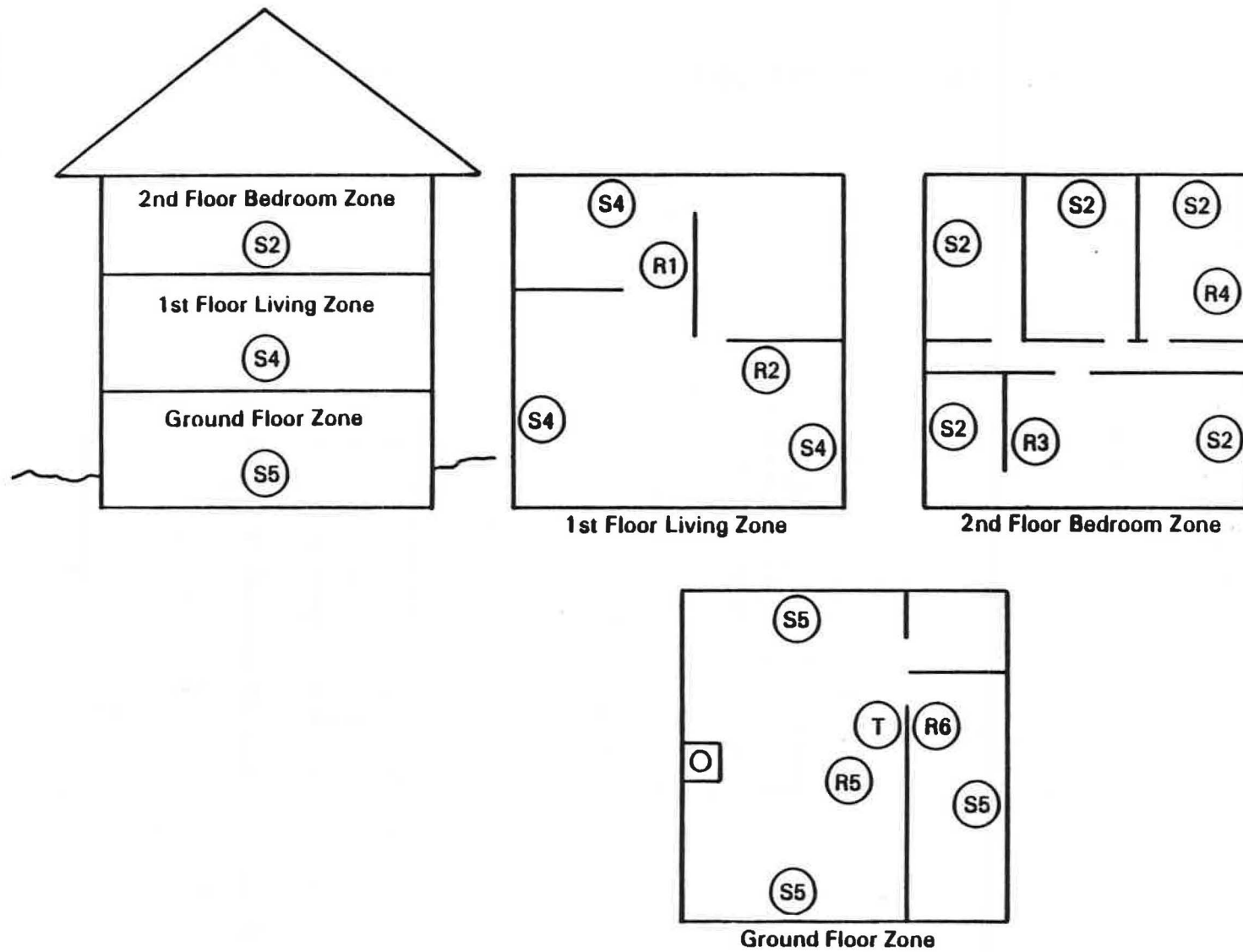


FIGURE A.4. PFT Placement Strategy for a Home with Two Levels above the Ground Floor

A.5

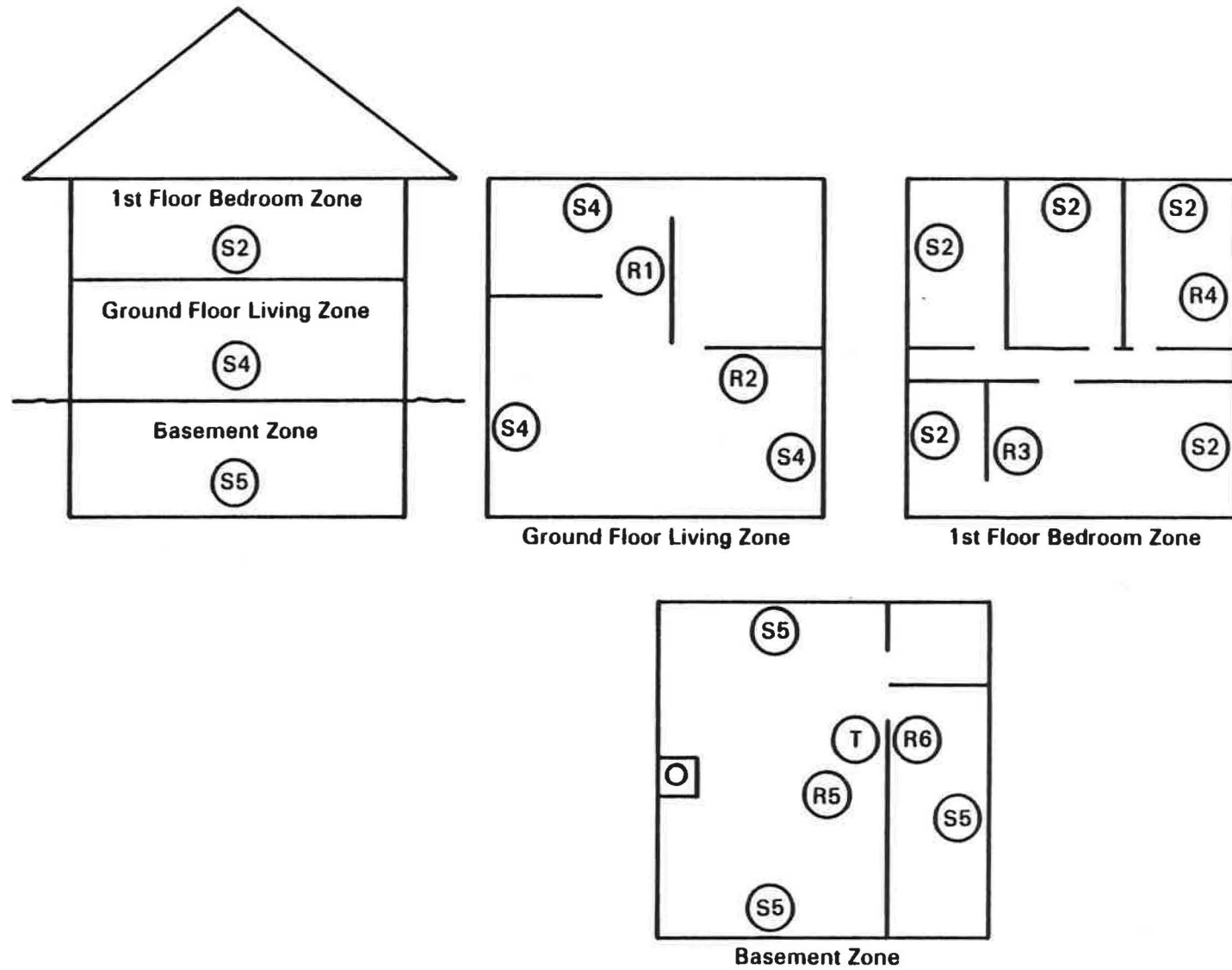


FIGURE A.5. PFT Placement Strategy for a Home with One Level above the Ground Floor and with a Basement

APPENDIX B

FORMS

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Parkhurst

ID# 501

DATE: 10 / 26 / 87

SUGGESTED PFT ZONES

NOTE: THIS HOUSE SHOULD
BE TESTED WITH DUCTS TAPED
IF POSSIBLE!!

This is a suggested scheme for placement of PFT sources and RATS based on information obtained during the telephone survey. The final placement scheme is up to you and will be recorded on both the STRUCTURE MEASUREMENT AND SKETCHES and the PFT DATA SHEET.

EST. # OF PFT ZONES IN HOME 3

EST. # OF RATS IN HOME 5-6

ZONE #1 Description LIVING / KITCHEN / LOFT

Approximate # of RATS (R) 2-3

Paired: Y(N) / Location(s) _____

Source Type (S) 4 (blue)

ZONE #2 Description Bedrooms

Approximate # of RATS (R) 2

Paired: Y(N) / Location(s) 1 Bedroom of your choice

Source Type (S) 2 (red)

ZONE #3 Description BASEMENT

Approximate # of RATS (R) 1

Paired: Y(N) / Location(s) _____

Source Type (S) 5 (black)

NORIS FIELD MEASUREMENT DATA

ID# 501

A. Site ID#

B. Blower Door Test Date 10/30/87

C. Company Number 2

1. Benchmark 2. Quality Conserv. 3. Enspect 4. Sound Conserv. 5. G. Gregg

D. Specialist(s) 6,7 1. George 2. Hal 3. David 4. Jim 5. Randy 6. John 7. Jack 8. Toby 9. Other

Be sure to bring in sources before starting!

HOMEOWNER SURVEY

How many adults and children are in your family?

M. # adults (>13) 2 N. # children (<13) 0

O. In what year was your home built? 19 87

(Stop! Call if before 1980.)

P. Is there an interior basement door from upstairs to downstairs? yes no (Circle one)

Q. Is it normally closed or open: closed open (Circle one)

R. What is the primary heat source? (Check one)

S. What is the secondary heat source? (Check one)

- 1. zoned active (fan) _____
- 2. zoned baseboard _____
- 3. zoned ceiling _____
- 4. zoned wall (passive) _____
- 5. central forced air elec. _____
- 6. electric heat pump
- 7. oil, gas, coal furnace _____
- 8. wood stove or insert _____
- 9. other (describe) _____
- 10. none _____

- 1. zoned active (fan) _____
- 2. zoned baseboard _____
- 3. zoned ceiling _____
- 4. zoned wall (passive) _____
- 5. central forced air elec. _____
- 6. electric heat pump _____
- 7. oil, gas, coal furnace _____
- 8. wood stove or insert
- 9. other (describe) _____
- 10. none _____

T. Is there more than one thermostat for primary system? yes no (Circle one)

U. Are there major areas of your home that will be closed off 24 hours a day in next 3 weeks?

yes no (Circle one)

V. Which areas? (Note how many)

1. basement 2. bedrooms 1 3. entire floor _____ 4. other (describe) shop

W. Is the house occupied more than half of the day-time during weekdays? yes no (Circle one)

X. Has any additional weatherization been performed since you moved into the home? Check all that apply

1. caulk/weatherstrip _____ 2. storm windows/doors _____ 3. wall/attic insulation _____

Y. How many hours per day are kitchen, bathroom and other exhaust fans and inside dryer operated?

0.5 total hours (nearest 1/2 hour)

Z. Have you (the occupant) noticed any odors or moisture problems? (Check one)

0. none 1. odors _____ 2. moisture _____ 3. both _____

Resident Parkhurst

Date 10/30/97

WALKTHROUGH SURVEY

Have occupant "tag" along with you

STRUCTURE

- AA. Number of Levels (Check one)
- | | | | |
|---|-------|---|----------|
| 1. single level with no basement | _____ | 4. multi-level with conditioned basement | <u>X</u> |
| 2. multi-level with no basement | _____ | 5. single-level with unconditioned basement | _____ |
| 3. single level with conditioned basement | _____ | 6. multi-level with unconditioned basement | _____ |

- AB. Primary exterior wall type: (Check one)
- | | | | | | | | | | |
|---------------|-------|---------------|----------|----------|-------|-----------|-------|--------|-------|
| 1. framed 2x4 | _____ | 2. framed 2x6 | <u>X</u> | 3. brick | _____ | 4. stucco | _____ | 5. log | _____ |
|---------------|-------|---------------|----------|----------|-------|-----------|-------|--------|-------|

- AC. Primary foundation type (>50%): (split entry [day light basement] is #1) (Check one)
- | | | | | | |
|--|-------|-------------|-------|----------------------|----------|
| 1. slab on grade | _____ | 2. basement | _____ | 3. vented crawlspace | <u>X</u> |
| 4. unvented crawlspace (if >50% of vents are closed, it is unvented) | | | | | _____ |

- AD. Type of basement: (Check one)
- | | |
|---|----------|
| 1. fully below grade | <u>X</u> |
| 2. daylight (1 or more walls above grade) | _____ |

ROOMS IN HOME (do not count a room twice)

- | | | | |
|-----------------------------------|------------------------------|-----------------------------|----------|
| AE. Number of bedrooms | <u>3</u> | AF. Number of bathrooms | <u>3</u> |
| AG. Number of living/family rooms | <u>1</u> | AH. Number of kitchens | <u>1</u> |
| AI. Number of dining rooms | <u>0</u> | AJ. Number of utility rooms | <u>1</u> |
| AK. Other (type and #) | <u>loft, shop, Sun space</u> | | |

EXHAUST FANS (conditioned space)

- | | |
|--|----------|
| AL. Number of kitchen exhaust fans | <u>1</u> |
| AM. Number of bathroom exhaust fans | <u>4</u> |
| AN. Number of other exhaust fans (incl. dryer) | <u>2</u> |

ALL OTHER FANS (Note zone and describe)

*Zone 1 Sunspace exhaust
Zone 1 Air movement fans to
fan sunspace - near
ceiling (see sketch)*

HEATING SYSTEMS

- AO. What is the primary installed electric heating system type (not necessarily the one used). (Check one)
- | | | | |
|-------------------------------|-------|---|----------|
| 1. zoned active (fans) | _____ | 2. zoned passive (baseboard, wall, ceiling-radiant) | _____ |
| 3. central forced air furnace | _____ | 4. heat pump | <u>X</u> |

- | | |
|---|----------|
| AP. Number of stove(s)/insert(s) with outside combustion air | <u>1</u> |
| AQ. Number of stove(s)/insert(s) without outside combustion air | _____ |
| AR. Number of fireplace(s) with outside combustion air | _____ |
| AS. Number of fireplace(s) without outside combustion air | _____ |

- AT. Specialist (your) observation of odors or moisture (Check one)
- | | | | | | | | |
|---------|-------|----------|----------|-------------|-------|---------|-------|
| 0. none | _____ | 1. odors | <u>X</u> | 2. moisture | _____ | 3. both | _____ |
|---------|-------|----------|----------|-------------|-------|---------|-------|
- new home smell*

Take dimensions, sketch, deploy and secure [Temperature Recorder] and PFT Sources and record room temperature with sources.

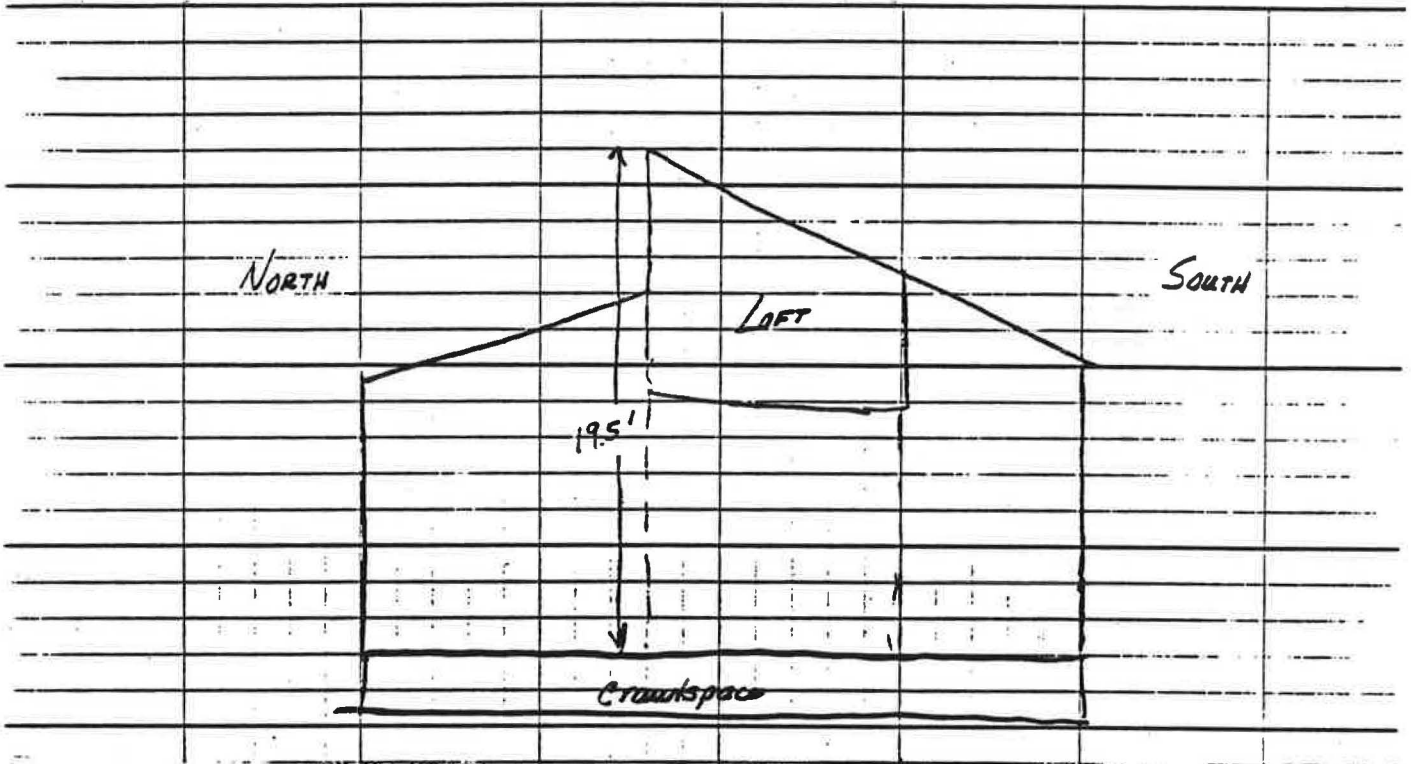
Resident Parkhurst

Date 10/30/87

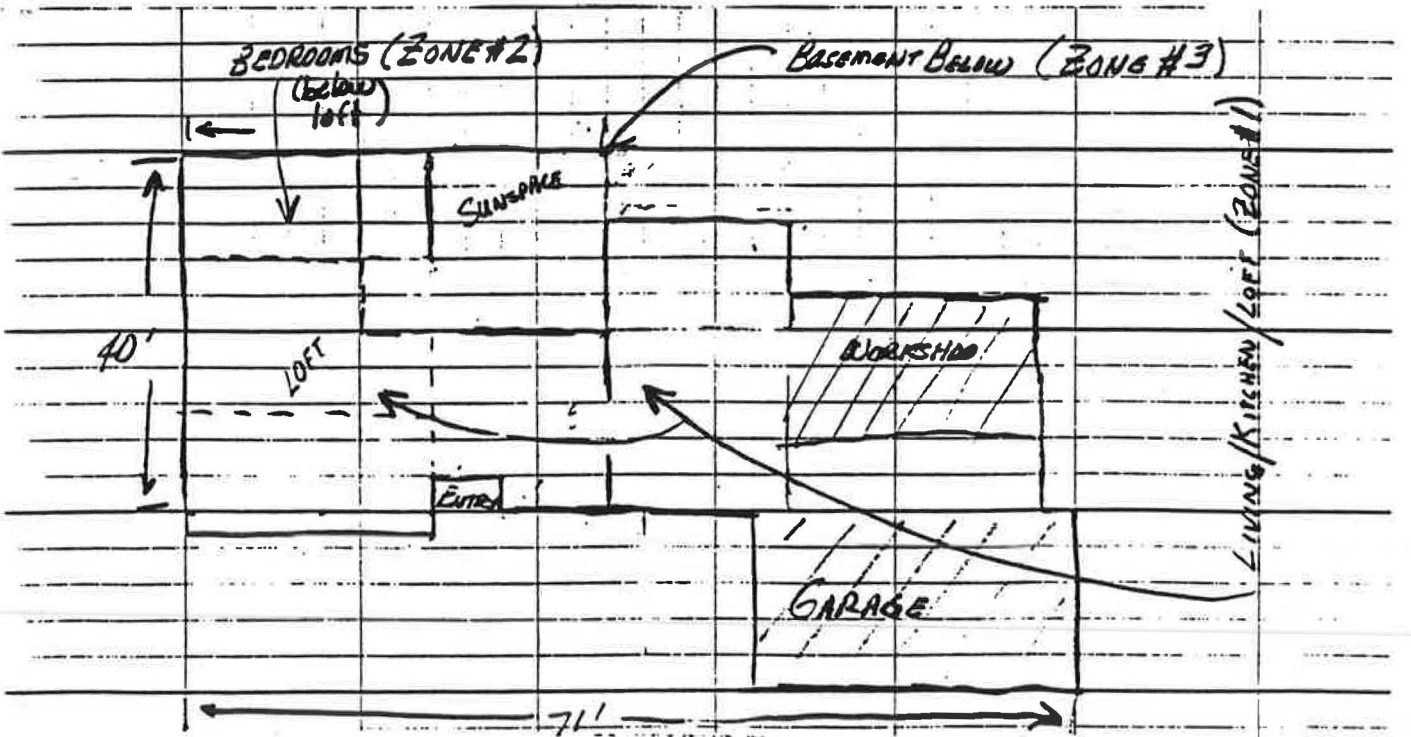
STRUCTURE MEASUREMENT AND SKETCHES

WHOLE HOUSE: Record accurate dimensions and PFT zone #s (only) on both sketches.

Section Sketch (Show Grade)



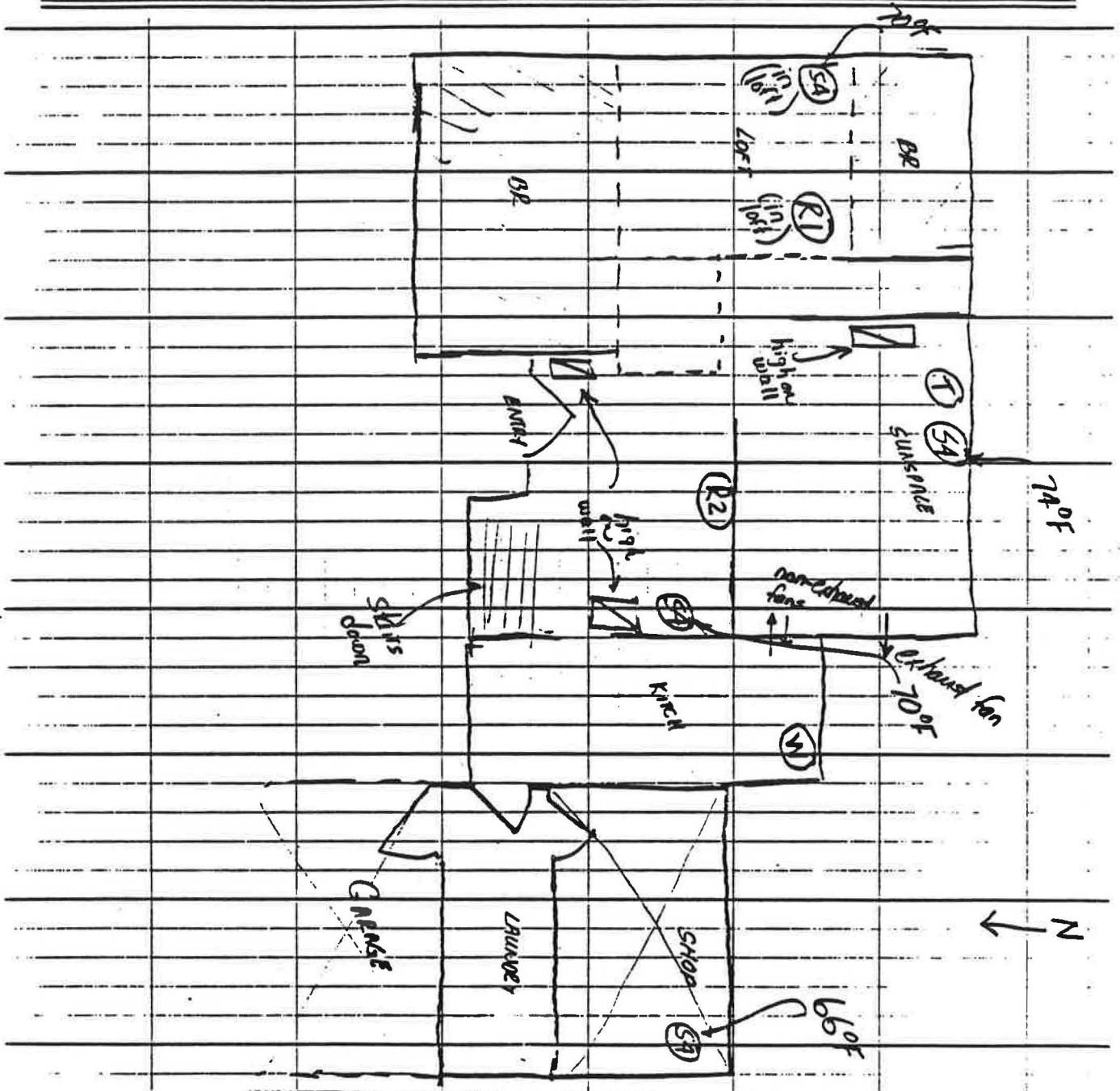
Plan Sketch



Resident Porkhurst

Date 10/30/87

FIRST PFT ZONE (Plan Sketch)



Avg. Ceiling Height: 15.0 ft

AU. Living Floor Area F1 = 1097 ft² (incl. loft)

AV. Volume: V1 = 18,882 ft³

AX. Ave. Zone Temperature: T1 = 70 °F

Show Locations:

- (W) = Woodstove
- (T) = Temp. Recorder
- (S#) = PFT Source
- (R#) = RATS

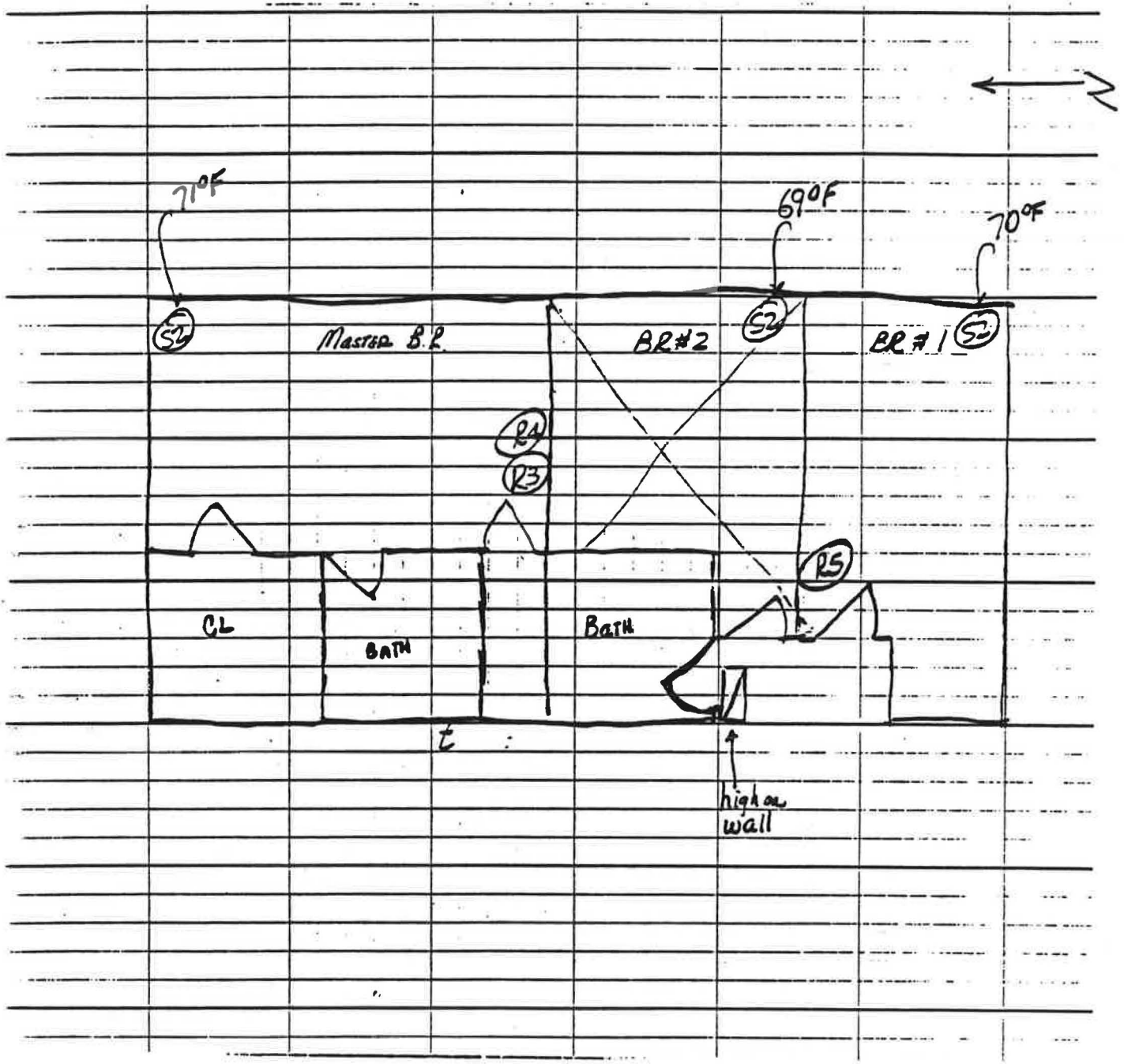
- ▢ = Forced-Air Return Grill
- (F) = Fireplace
- t = Thermostat
- f = Furnace
- x = Closed-Off Room

12/87

Resident Porkhurst

Date 01/30/87

SECOND PFT ZONE (Plan Sketch)



Avg. Ceiling Height: 8.0 ft

AY. Living Floor Area F2 = 800 ft²

AZ. Volume: V2 = 6400 ft³

BA. Ave. Zone Temperature: T2 = 70 °F

Show Locations:

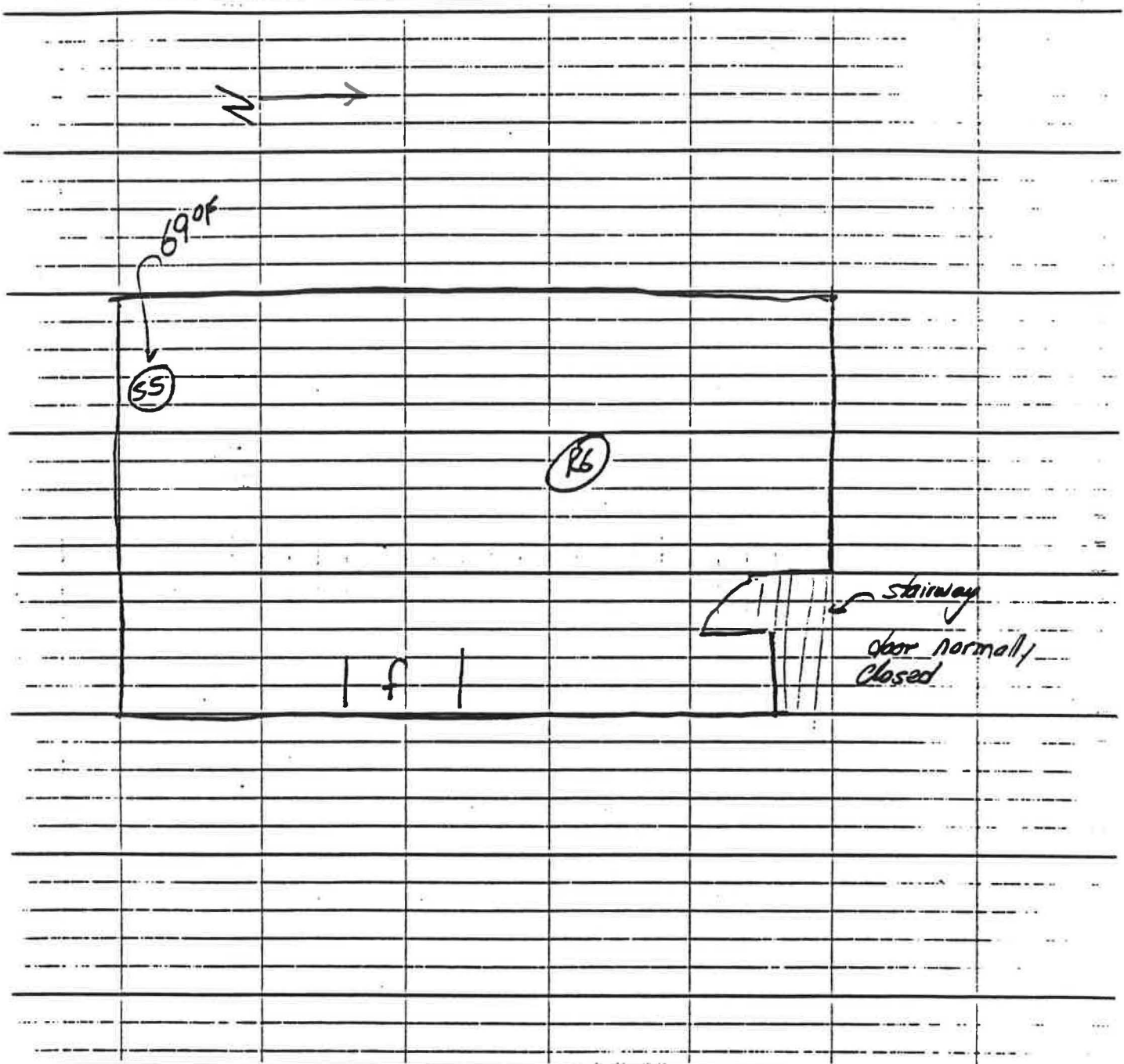
- (W) = Woodstove
- (T) = Temp Recorder
- (S) = PFT Source
- (R) = RATS

- ☒ = Forced-Air Return Grill
- (F) = Fireplace
- t = Thermostat
- f = Furnace
- X = Closed-Off Room

Resident Parkhurst

Date 10/30/87

THIRD PFT ZONE (Plan Sketch)



Avg. Ceiling Height: 9.66 ft.

BB. Living Floor Area F3 = 400 ft²

BC. Volume: V3 = 3864 ft³

BD. Ave. Zone Temperature: T3 = 69 °F

Show Locations:

- (W) = Woodstove
- (T) = Temp. Recorder
- (S#) = PFT Source
- (R#) = RATS

- = Forced-Air Return Grill
- (F) = Fireplace
- t = Thermostat
- f = Furnace
- x = Closed-Off Room

METEOROLOGICAL DATA AND EXTERIOR BUILDING PARAMETERS

Reminder: Return all unused sources to cab of vehicle before completing.

BE. Outdoor Temperature 52 °F.

BF.	Uncorrected Station Pressure	_____	inches
BG.	Blower Door Pressure Setting	_____	inches
	Site altitude	_____	ft. Airport or other FAA site used _____
BH.	Ave. OAT	_____	°C
	BE Ave. windspeed	_____	m/s
	BI. Met Station#	_____	

BK. Wind Speed 0 (calm) mph (best guess)

BL. Wind gusts to 0 (calm) mph (best guess)

BM. Regional Terrain (Circle one) (see Reference Table below)

- I II III IV V

BN. Local Shielding Type (Circle one) (see Reference Table below)

- I II III IV V

BO. Weather Station Terrain Class

- I II III IV V

BP.. Overall building height (lowest leak to highest leak): 19.5 ft.

Reminder: Take two Polaroid photos of the exterior of the house from different angles and write house ID# on back of photos.

REFERENCE TABLE

BM. REGIONAL TERRAIN (5 mi):

- I Unobstructed plain, ocean or other water body.
- II Generally flat with some isolated obstacles (well separated buildings or trees).
- III Suburban areas with low buildings, trees, etc.
- IV Urban, industrial, forested area, valley, or lee side of hill.
- V Center of a big city or middle of thick forest of tall trees..

BN. LOCAL SHIELDING TYPE (30 ft):

- I No obstructions or local shielding.
- II Light local shielding with minimal obstructions. Perhaps a few trees or a shed
- III Light local shielding with some obstruction on one side.
A thick hedge, solid fence or one neighboring house.
- IV Moderate shielding around much of perimeter (buildings or mature trees).
- V Heavy shielding - large obstructions surrounding house perimeter.

NOTE: THIS HOUSE SHOULD
BE TESTED WITH DUCTS TAPED
IF POSSIBLE!!

Resident Parkhurst Date 10/30/27

BLOWER DOOR TEST

BQ. Door Type/Model Retrotec
BS. Total Volume (V1+V2+V3) 29,146 ft³

BR. Avg. Indoor Temp : $\frac{T1+T2}{2}$ or $\frac{T1+T2+T3}{3}$ 70 °F
BT. Total Floor Area: (F1+F2+F3) 2297 ft²

Distribution of leakage area:	
Fraction of total leakage	
BU. ceiling	%
BV. wall	%
BW. floor	%

Identify the 4-5 greatest leakage sources in home

1. floor to crawlspace
2. exhaust vents - bathrooms
3. exhaust vent from surfaces
4. _____
5. _____

BX. Natural ΔP (offset) 0 pa

First Blower Door Test (Ducts Not Taped)

Depressurization Test		
House Pressure		
Target	Actual	Flow (cfm)
(15) (0.06)	<u>15</u>	<u>1484</u>
(18) (0.07)	<u>20</u>	<u>1832</u>
(22) (0.09)	<u>22</u>	<u>1939</u>
(27) (0.11)	<u>30</u>	<u>2390</u>
(33) (0.13)	<u>33</u>	<u>2572</u>
(40) (0.16)	<u>40</u>	<u>2943</u>
(49) (0.19)	<u>50</u>	<u>3446</u>
(60) (0.24)	<u>60</u>	<u>3939</u>

Pressurization Test		
House Pressure		
Target	Actual	Flow (cfm)
(15) (0.06)	<u>15</u>	<u>1507</u>
(18) (0.07)	<u>20</u>	<u>1873</u>
(22) (0.09)	<u>22</u>	<u>2004</u>
(27) (0.11)	<u>30</u>	<u>2490</u>
(33) (0.13)	<u>33</u>	<u>2711</u>
(40) (0.16)	<u>40</u>	<u>3189</u>
(49) (0.19)	<u>50</u>	<u>3687</u>
(60) (0.24)	<u>60</u>	<u>4220</u>

Second Blower Door Test (Ducts Not Taped) *Not done*

Depressurization Test		
House Pressure		
Target	Actual	Flow (cfm)
(15) (0.06)	_____	_____
(18) (0.07)	_____	_____
(22) (0.09)	_____	_____
(27) (0.11)	_____	_____
(33) (0.13)	_____	_____
(40) (0.16)	_____	_____
(49) (0.19)	_____	_____
(60) (0.24)	_____	_____

Pressurization Test		
House Pressure		
Target	Actual	Flow (cfm)
(15) (0.06)	_____	_____
(18) (0.07)	_____	_____
(22) (0.09)	_____	_____
(27) (0.11)	_____	_____
(33) (0.13)	_____	_____
(40) (0.16)	_____	_____
(49) (0.19)	_____	_____
(60) (0.24)	_____	_____

Did you seal any exhaust vents prior to depressurization test? yes no (Circle one) If so, how many? 3

Return blower door to vehicle. Take out RATS and holders from hood or bed. Hang the RATS and note UNCAP DATE and TIME on PFT Data Sheet and Short Form. Also note location of RATS R# on Short Form. Structure Measurements and Sketches and PFT Data Sheet. BE CONSISTENT ON ALL FORMS.

Resident Parkhurst Date 10/20/87

BLOWER DOOR TEST WITH DUCTS TAPED

Depressurization Test		
House Pressure		
Target	Actual	Flow (cfm)
(15) (0:06)	_____	_____
(18) (0:07)	_____	_____
(22) (0:09)	_____	_____
(27) (0:11)	_____	_____
(33) (0:13)	_____	_____
(40) (0:16)	_____	_____
(49) (0:19)	_____	_____
(60) (0:24)	_____	_____

Depressurization Test		
House Pressure		
Target	Actual	Flow (cfm)
(15) (0:06)	_____	_____
(18) (0:07)	_____	_____
(22) (0:09)	_____	_____
(27) (0:11)	_____	_____
(33) (0:13)	_____	_____
(40) (0:16)	_____	_____
(49) (0:19)	_____	_____
(60) (0:24)	_____	_____

Test not done - unable to reach all ducts for taping - resident also reluctant to have done.

NOTE: THIS HOUSE SHOULD
BE TESTED WITH DUCTS TAPED
IF POSSIBLE!!

Return blower door to vehicle. Take out RATS and holders from hood or bed. Hang the RATS and note UNCAP DATE and TIME on *PFT Data Sheet* and *Short Form*. Also note location of RATS R# on *Short Form*, *Structure Measurement and Sketches* and *PFT Data Sheet*. BE CONSISTENT ON ALL FORMS.

Parkhurst

ID# 501

OCCUPANT ACTIVITIES RECORD

Please record the following events on a daily basis each week of PFT testing.

Week of <u>10/25</u>	Mon	Tue	Wed	Thur	Fri	Sat	Sun
1. Hours of Woodstove Use							
2. Hours of Fireplace Use							
3. Hours of Opened Windows							
4. Minutes of all Exhaust Fan Use:							
5. Minutes of Clothes Dryer Use (inside home only)							
6. Unusual Events (Place number under appropriate day and indicate below the event and its impact)	1.						

10/29 10/30 10/31

(Example: 1. Party with several guests.)

Parkhurst

ID# 501

OCCUPANT ACTIVITIES RECORD

Please record the following events on a daily basis each week of PFT testing.

Week of <u>11/1 - 11/7</u>	Mon	Tue	Wed	Thur	Fri	Sat	Sun
1. <i>Hours of Woodstove Use</i>							
2. <i>Hours of Fireplace Use</i>							
3. <i>Hours of Opened Windows</i>							
4. <i>Minutes of all Exhaust Fan Use:</i>							
5. <i>Minutes of Clothes Dryer Use (inside home only)</i>							
6. <i>Unusual Events (Place number under appropriate day and indicate below the event and its impact)</i>	1.						

(Example: 1. Party with several guests.)

Parkhurst

ID# 501

OCCUPANT ACTIVITIES RECORD

Please record the following events on a daily basis each week of PFT testing.

Week of <u>11/8 - 11/14</u>	Mon	Tue	Wed	Thur	Fri	Sat	Sun
1. Hours of Woodstove Use							
2. Hours of Fireplace Use							
3. Hours of Opened Windows							
4. Minutes of all Exhaust Fan Use:							
5. Minutes of Clothes Dryer Use (inside home only)							
6. Unusual Events (Place number under appropriate day and indicate below the event and its impact)	1.						

(Example: 1. Party with several guests.)

Parkhurst

ID# 501

OCCUPANT ACTIVITIES RECORD

Please record the following events on a daily basis each week of PFT testing.

Week of <u>11/15 - 11/21</u>	Mon	Tue	Wed	Thur	Fri	Sat	Sun
1. <i>Hours of Woodstove Use</i>							
2. <i>Hours of Fireplace Use</i>							
3. <i>Hours of Opened Windows</i>							
4. <i>Minutes of all Exhaust Fan Use:</i>							
5. <i>Minutes of Clothes Dryer Use (inside home only)</i>							
6. <i>Unusual Events (Place number under appropriate day and indicate below the event and its impact)</i>	1.						

(Example: 1. Party with several guests.)

Resident Parkhurst

PFT DATA SHEET

BY. UNCAP DATE: 10 130 187
 BZ. UNCAP TIME: 2 : 00 am pm
 CA. CAP DATE: 1 1
 CB. CAP TIME: _____ : _____ am pm

ZONE #1
 Description Ground Floor Living Ave. Temp(T1) 70 °F Volume(V1) 18,882 ft³
 Temp Recorder Serial # -5 Location Sunspace on table S. wall

RATS (R)				Sources (S)	
ID# (4 digit)	Room	Hung From	R#	Source Code	# Sources
<u>2212</u>	<u>Loft</u>	<u>raib</u>	<u>1</u>	<u>4</u>	<u>4</u>
<u>2929</u>	<u>Living</u>	<u>ceiling</u>	<u>2</u>	<u>Room</u>	<u>Located on</u>
				<u>Loft</u>	<u>top of gun cab.</u>
				<u>Sunspace</u>	<u>top of table</u>
				<u>living</u>	<u>top of baseboard</u>
				<u>shop</u>	<u>top of door trim</u>

ZONE #2
 Description Ground Floor Bedroom Ave. Temp(T2) 70 °F Volume(V2) 6400 ft³
 Temp Recorder Serial # _____ Location _____

RATS (R)				Sources (S)	
ID# (4 digit)	Room	Hung From	R#	Source Code	# Sources
<u>2727</u>	<u>Master BR</u>	<u>ceiling by door</u>	<u>3.4</u>	<u>2</u>	<u>3</u>
<u>2729</u>	<u>BR#1</u>	<u>" " "</u>	<u>5</u>	<u>Room</u>	<u>Located on</u>
				<u>MBR</u>	<u>bed headboard</u>
				<u>BR#1</u>	<u>top of pix on wall</u>
				<u>BR#2</u>	<u>top of closet door trim</u>

ZONE #3
 Description Basement Ave. Temp(T3) 69 °F Volume(V3) 3864 ft³
 Temp Recorder Serial # _____ Location _____

RATS (R)				Sources (S)	
ID# (4 digit)	Room	Hung From	R#	Source Code	# Sources
<u>2002</u>	<u>Basement</u>	<u>floor joist</u>	<u>6</u>	<u>5</u>	<u>1</u>
				<u>Room</u>	<u>Located on</u>
				<u>Basmt</u>	<u>floor joist near ciel.</u>

Source Code:
 Red = 2
 Blue = 4
 Black = 5

CHECKLIST

Please indicate by a check mark that each item has been completed before you leave the home.

- [✓] COMPLETED HOMEOWNER SURVEY.
- [✓] COMPLETED *WALKTHROUGH SURVEY* AND NOTED ZONES, CLOSED OFF ROOMS, AND LOCATIONS OF PFT SOURCES S , AND TEMPERATURE RECORDER T ON *STRUCTURE MEASUREMENT AND SKETCHES* FORM.
- [✓] PLACED PFT SOURCES AND (OPTIONAL) TEMPERATURE RECORDER. ACTIVATED RECORDER.
- [✓] RECORDED METEOROLOGICAL DATA AND EXTERIOR BUILDING PARAMETERS.
- [✓] TOOK PHOTOGRAPH OF OUTSIDE OF HOME, LABELED IT AND PLACED IT IN BOOKLET.
- [✓] COMPLETED *BLOWER DOOR TEST* AND REMOVED ALL SEALING MATERIAL, COMPLETED TABLES AND INCLUDED COPY OF CALCULATIONS TAPE IN BOOKLET.
- [✓] HUNG RATS, R, UNCAPPED NUMBERED END OF TUBE AND PUSHED BACK RED CAP FROM END OF THE TUBE.
- [✓] RECORDED ALL INFORMATION ON *PFT DATA SHEET* IN BOOKLET.
- [✓] FILLED IN YOUR PART OF THE OCCUPANT'S *SHORT FORM* AND PLACED IN MAILER, AND EXPLAINED *OCCUPANT ACTIVITY RECORD* AND LEFT 4 OF THESE WITH OCCUPANT.
- [✓] LEFT MAILER, SPARE RED CAPS AND *INSTRUCTIONS FOR THE RESIDENT* AND DEMONSTRATED CORRECT RECOVERY AND MAILING PROCEDURES.
- [✓] CLEANED UP ANY DIRT/DEBRIS.
- [✓] THANKED THE RESIDENT FOR THEIR COOPERATION.

SHORT FORM

Parkhurst

Total # RATS in home 5

#501

To be Filled in by Occupant

UNCAP DATE: 10, 30, 87
UNCAP TIME: 2 : 00
(Circle One) am pm

CAP DATE	CAP TIME	(Circle One)
		am pm

R#	Room/Location
<u>1</u>	<u>Left - on rail</u>
<u>2</u>	<u>Living - from ceiling</u>
<u>3</u>	<u>Master Bedroom / ceiling by door</u>
<u>4 5</u>	<u>Bedroom #1 / ceiling by door</u>
<u>6</u>	<u>Basement / ceiling joist</u>

INSTRUCTIONS FOR THE RESIDENT

These instructions will guide you in the recovery of the PFT (GLASS) sample tubes that are hanging from your ceiling in foam holders. Instructions are also provided for recovery of a TEMPERATURE RECORDER. (if one was placed in your home)

Battelle will be calling you in a few weeks when it is time to recover the sample tubes and/or temperature recorder. Please follow the instructions carefully. If at any time you do not understand a step, STOP and give us a call COLLECT at (509) 375-3799.

STEP #1 Take down all of the foam holders containing the GLASS sample tubes. We will tell you at the time we call you where we think each foam holder is located and the total number of tubes.



GLASS TUBE

NOTE: DO NOT REMOVE the small colored metal capsules that are secured with putty. Never place the glass tubes near the metal capsules when handling tubes. We will call you and ask you to remove and mail the capsules.



CAPSULE

STEP #2 Leave the glass tubes in the foam holder and slip the red cap at the end of the tube over the open end and secure. If the red cap is missing, use one of the extra caps supplied in the mailer.

STEP #3 Record the DATE and TIME you finished CAPPING the tubes on the *SHORT FORM* that is found inside the mailer. Record the time to the NEAREST ONE-HALF HOUR (i.e. 4:30 pm, 5:00 pm, 5:30 pm, etc.) Place the *SHORT FORM* back inside the mailer.

STEP #4 Place your up-to-date *OCCUPANT ACTIVITY RECORDS* you have been keeping in the mailer. If you can't locate all the activity records, mail them to us later.

STEP #5 Wrap the string on the holder around the glass tubes and holders to secure tubes. Place the foam holders containing the sample tubes in the mailer in a single layer.

ADDITIONAL STEP FOR HOMES WITH A TEMPERATURE RECORDER

(We will inform you if you have a temperature recorder and where we think it is)



STEP #6 Remove the recorder from its location and place it in the mailer also. **YOU DO NOT HAVE TO TURN IT OFF, PLEASE DO NOT EVEN TRY.**

LAST STEP Seal the mailer and place package outside in your mailbox as soon as possible. NO POSTAGE IS REQUIRED.

Thank you for assisting us.