KNOW YOUR HOME

Massachusetts

This comprehensive Homeowner guide contains many important facts concerning your new home. All information in this manual is considered to be an integral part of your Home Inspection Report. This guide is easy to follow because it's categorized into components that will correspond with your inspection report (Plumbing, Heating, Electrical, Etc). Many questions that you may have pertaining to your new Home components and your Home Inspection Report will be explicitly detailed in this manual.

It is impossible to cover everything that would pertain to your particular home; however, the most common questions that do arise on typical homes will be covered in this manual. I have also included recommended maintenance tips that periodically need your attention in order to help keep your home and its mechanical components in top notch condition.

If you still have questions after reading this manual, please don't hesitate to contact me directly, as I strive to keep all my clients well informed and I want you to…**Know Your Home.**

Please file this manual and your Inspection report in a safe place for future reference.

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PART 1

GENERAL INFORMATION

A) Your Home Inspection Report

The primary objective of a home inspection is to provide you with information about the home and any major defects before you buy it. All homes have defects; the perfect home just does not exist. Potential home buyers often incorrectly view my inspection report as a mandatory repair list for the Seller. The fact is that Sellers are not required to produce a flawless house. They have no such obligation by law or by contract; therefore, most repairs are subject to negotiation between you and the Seller.

Typically, Buyers will request that various conditions be repaired before the close of escrow, and Sellers will usually agree to some of those demands. But with most building defects, Sellers make repairs as a matter of choice, not obligation, in order to foster good will or to help accomplish the sale. Sellers can refuse any repair demands except where requirements are set forth by state law, local ordinance or the real estate purchase contract. Purchase contracts usually stipulate that safety issues be resolved, fixtures working, windows not be broken, and that there be no leaks in the roof or plumbing.

Before you make any demands of the Seller, try to evaluate the inspection report with an eye toward problems of greatest significance. Look for conditions that compromise health and safety or involve potential or active leaks in the plumbing or the roof. Most sellers will address problems affecting crucial areas or items such as the roof, electrical, plumbing problems and big-ticket items such as the furnace and water heater. Please consult with your Realtor to help you work through an appropriate repair request list to present to the seller. If you have any questions about any item in your home inspection report, please contact me at **1-978-683-4984.**

B) Copyright and Confidentiality

The report contained in your folder is a copyrighted confidential document prepared for you only. Information is not transferable to third parties by any person or entity, including Client and/or real estate brokers and agents, without written permission from Massachusetts Home Inspections. Use of all disclosures contained in the report is specifically restricted to the transaction for which the inspection was performed. I will not disclose any information to anyone who is not a party to the Home Inspection Agreement which was signed by you and enclosed in your blue report folder. Duplication and dissemination by any means is prohibited without prior written permission and authorization from Massachusetts Home Inspections.

Duplication of, use of, or reliance on the home inspection report in any way for any purpose whatsoever has the effect of agreeing to the terms and conditions as set forth in the Home Inspection Agreement. Unauthorized duplication of, use of, or reliance on this report has the effect of all parties agreeing to hold harmless, individually, jointly, and/or otherwise, Massachusetts Home Inspections, its directors, employees and assigns, and may be a violation of federal and/or international copyright laws.

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Massachusetts Home Inspections cannot control the interpretation and use of its reports by third parties and shall not assume any legal responsibility or liability for third party interpretations of any part of the report beyond the date of the inspection.

Since real estate conditions change on a daily basis in response to occupants' use, deferred upkeep, and environmental conditions, third parties may read this report but shall not rely upon its contents for any purpose. Future buyers who enter into a purchase contract for your property should call Massachusetts Home Inspections for a personal on-site review and update of the conditions described in your report. A discounted fee for the update is available as long as the update request is scheduled for a date within 60 days of the date of your report. Failure to comply with this request shall relieve and hold harmless individually, jointly, and/or otherwise, Massachusetts Home Inspections, of any responsibility or liability, moral or legal, to the eventual buyers in contract for any property condition, any lack of understanding, and/or any possible misinterpretation of disclosed conditions contained within your report.

I know that third parties review my reports because of disclosure laws, and some even rely on old reports to purchase their properties. This section is another blatant attempt to address the Leko decision in the state of California and address third parties using the report to buy the property without getting their own home inspection done. Imagine buying a $394,000 property (the average price of real estate in Massachusetts) and not spending a mere $300.00 on a home inspection report. It simply doesn't make sense to me.

C) A Perfect Report

Occasional typographical errors will occur, and I apologize for those in advance. Plurals and singulars are used interchangeably throughout the report and should not be taken to specifically indicate only one or the presence of more than one. When items are naturally grouped together (e.g., lights and switches), it is NOT an indication that all items in the group were present or observed, functioning or not functioning, or did or did not exhibit problems or concerns.

Every component that is within your prospective property is included in your report. If you can not locate a specific component within your report, than you do not have that component within the property. I include components specific to your home inspection only. At times, there are many issues that I try to annotate on your report; However, I am not perfect. If there is anything that you feel that I have missed or something that should be mentioned in your report, please contact me and I'll gladly fax or email you an addendum to your original report.

D) Existing Conditions

Virtually all houses have problems, regardless of age or usage. It is not my purpose to compile a complete, definitive, or exhaustive list of items that need repair, but to document the general condition of the residence and to note any visible major defects (please read the top front page of your Home Inspection report for the definition of "Defective"). This is not a comprehensive document about the structure and should not be relied upon as such.

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Cosmetic considerations (paint, wall covering, carpeting, window coverings, etc.) and minor flaws are not within the scope of my inspection. Although some minor and cosmetic flaws might be noted in your report as a courtesy to you, a list of the minor and cosmetic flaws noted in the report should not be considered a complete, definitive, or exhaustive list and should not be relied upon as such.
Routine maintenance and safety items are not within the scope of my inspection unless they otherwise constitute visible major defects as defined in your Home Inspection Report. Your report does not include all maintenance items and should not be relied upon for such items. Any recommendations that Massachusetts Home Inspections makes for service, a second opinion, or permit research involving any component or condition should be completed and documented before the close of escrow, or Massachusetts Home Inspections will be held harmless for any subsequently alleged defects.

I report all conditions as they existed at the time of the inspection. The information contained in your report may be unreliable beyond the date of the inspection due to changing conditions. Your inspection was essentially visual, is not technically exhaustive, and does not imply that every defect was found. Latent and concealed defects and deficiencies are excluded from the inspection. Cosmetic flaws and defects will not be a part of your Home Inspection.

E) Home Inspectors, Licensed Specialists and Experts

Home Inspectors are generalists, are not acting as experts in any craft or trade, and are conducting what is essentially a visual inspection. Home inspectors generally know something about everything and everything about nothing. The State of Massachusetts law, therefore, requires that inspectors defer to qualified and licensed experts (e.g., plumber, electrician, etc.) in certain instances. If I recommend consulting specialists or experts, Client agrees to do so at Client's expense. Because such qualified personnel are experts, it is possible that they will discover additional problems that I, as a generalist, cannot. Any listed items in your report concerning areas reserved by Massachusetts law to such licensed experts should not be construed as a detailed, comprehensive, and/or exhaustive list of problems or areas of concern.

Massachusetts Home Inspections highly recommends that any additional recommended inspections, evaluations, consultation, repair, and/or replacement be performed by qualified experts or licensed specialists before close of escrow. For repairs which might require a licensed specialist, I recommend that you obtain at least three written quotes concerning any work to be done. You should also request repair and remediation by such licensed specialists in lieu of seller, and you should request receipts for such work since seller, home owner, and other unlicensed individuals cannot guarantee or warranty their work.

For common area properties such as Condominiums and Town homes, homeowner associations sometimes have qualified maintenance personnel available to help resolve problems, typically free or at a lower cost than independent qualified service personnel. Inquiry of homeowner associations should be made before hiring independent qualified service personnel. If I don't make a specific recommendation concerning a specific item or area of concern, you should examine the item in question to determine your own needs relative to the item.

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F) Building Permits

If you're buying a home that has been remodeled over time, there's a good chance that some of the work was done without permits. It's a good idea to ask sellers if all work was completed with permits. In Massachusetts, sellers are required to disclose any work that was done without permits. However, in some cases, the sellers may not be aware that work was done without permits. Sometimes contractors don't take out permits to save time. So, it's important to check this. Before you buy a home where work has been done without permits, make sure you understand what the future consequences might be.

If you search the municipal permit record during your inspection contingency time period, there's an opportunity to negotiate a satisfactory resolution to permit issues before you close.

G) Common Components and Common Areas

I do not test, analyze, inspect, or offer an opinion on the condition or function of areas or structural components common to more than one unit, systems serving more than one unit, or areas which typically are under the jurisdiction of a homeowners' association, including, but not limited to, structure exterior (including decks, balconies, porches, patios, and parking structures), roof, chimney foundation, fences, and utility service entries. Some areas or systems may or may not be under the jurisdiction of the association (garage, water heater, laundry, etc.).

Homeowners' associations sometimes have qualified personnel who can assist you with many areas of concern, sometimes at little or no cost. I recommend always consulting with homeowners' association prior to commencing any work whatsoever.

BEFORE CLOSE OF ESCROW, I RECOMMEND: (1) Walking property to determine if homeowners' association is maintaining structures and property in a condition satisfactory to Client; (2) Having qualified homeowners' association personnel inspect all common area structural systems and mechanical components servicing this condominium, particularly, but not limited to, foundation, structure exterior, roof, and chimney; (3) Acquiring homeowners' association public records, minutes, bylaws, budget, etc., to help determine any consistent problems with common area grounds or components; (4) Checking with homeowners' association concerning Client's responsibility and any non-recurring fees, dues, or assessments which might be forthcoming.

H) Why I'm not specific

When I'm not specific about where a problem is, is not because I'm trying to be obstinate or that I didn't make specific notes about your home. There really is some logic about the method to my madness. When I am specific about a problem, it is because the problem is not common and is not expected to re-occur once it has been resolved.

An example of being specific would be when I state that the hot water faucet in bathroom did not work. When that is corrected, it is not expected to re-occur in the near future, and such an abnormal condition is not common and is not to be expected to exist at the same time in the other bathrooms. An example of not being specific would be when I state that corrosion was present

on the drainage pipes and valves in the sink cabinets. I would not note what specific sink because corrosion is so common that it could be present at the water and drainage pipes and valves in all sink cabinets by the time you move in. Additionally, especially in a furnished residence, I usually can't see many of the common problems because they are obscured by furnishings; storage, etc. (Read the part 3A- "**Living Space - Home Inspectors as Movers"**).

When I am not specific, it is my goal to force you to examine all similar areas when you move in (or as soon as all furnishings have been removed) and then take appropriate action for the conditions described generally in my report and which you might see upon your inspection of similar areas. I realize that at times this can be confusing or frustrating to you, so if you have any questions about me not being specific, please call me.

It doesn't do you or me any good if you're sitting in your home confused, frustrated, wondering, or blaming the home inspector for missing something. If you are requesting repairs of the seller for an item on which I was not specific, I believe your request should use the term "all." For example, instead of requesting that the screen window in the left 1st floor bedroom be replaced (screen windows are easily damaged during move-out), request that "all screen windows be present and undamaged after move-out," or something to that effect. Consult with your Realtor to help you prepare an appropriate list of requested repairs for the seller. Again, don't be shy, call me at **1-978-683-4984,** if you have any questions or need clarification on anything that is noted in your report.

I) Vacant Residence

A vacant residence presents its own types of problems. Although vacant residences typically are unfurnished, meaning that I can see virtually everything, residences that are vacant for any period of time can be expected to present problems upon move-in. Some structural and mechanical components and systems that have not been used on a daily basis can be expected to fail upon first use. A home is meant to be used, meaning that a fully functioning home requires proper use, care, and maintenance. When a residence is vacant, there is no one to do regular monitoring and maintenance. Think about the "haunted house" on television or within your city when you were growing up. It was vacant and dilapidated, and deterioration was continuing on a daily basis because no one was around to take care of it. Same thing happens with any vacant residence, new or used. Deterioration is an ongoing process; it does not quit simply because a residence is vacant. I recommend that, during the escrow period, you compile a list of qualified service personnel (plumber, electrician, appliance repair, etc.) and telephone numbers to assist you in the event of any emergency during the move-in process.

If the residence has been vacant for more than a few days prior to the home inspection, there is a possibility that the testing we did during the home inspection might have caused some problems. For example, the most common problem caused by home inspections in vacant residences has to do with plumbing leaks. When water faucets and drain pipes are not used on a regular basis, their components can dry out and harden. The first time they are used, then, might result in damage to interior components, such as o-rings at the water faucet. The damage might not be apparent until you turn the water faucet on when you move in. My testing might have damaged the dried out, hardened O-ring while your first operation of the same faucet after my testing actually dislodged the o-ring fragments and caused the faucet or handles to start leaking. It's no one's "fault,"

really; it's just a consequence of what happens with vacant homes, when homes are not lived in, used, and maintained on a daily basis.

Hydrogen gas can accumulate in hot water systems that have not been operated for a period of time, such as in vacant residences. Under adverse conditions, this hydrogen gas can cause fires at faucets and explosions at water-using appliances. If your new home has been vacant for more than a few days, flush the hot water system by turning on all hot water faucets and letting them run for several minutes. Do not use the hot water faucets near any open flames (cigarettes, candles, etc.) and do not use any hot-water-using appliances (dishwasher) or nearby heat-producing appliances (dishwasher, cook top, etc.) until the hot water system has been flushed. If you have a multi-story residence, start turning on hot water faucets in the highest floor first and work your way down to the lower floors.

J) Newer Home vs. Older Home

The main advantage to a **Newer home** is that there is less damage, both from Mother Nature and from previous occupants. You typically get to create your own damage or watch it happen naturally. The main disadvantage to a newer home is that you do not know what kind of damage Mother Nature is going to inflict upon your house. With our changing New England weather, what you see may not be what you get years down the road.

The main advantage to an **Older home** is that Mother Nature has already inflicted the majority of damage upon your house, and additional damage probably won't occur unless hurricanes, heavy rains or winter blizzards occur, or unless of course, you alter the landscaping or remodel the structure itself. What you see is what you get. Unfortunately, you typically don't get to create your own damage or watch it happen naturally, and there are no fond memories associated with the damage that is there.

Because of the drastic weather changes we have here in New England, I typically define a **Newer home** as one that is less than ten years old because it typically will take about that many years to get enough rain and serious weather changes to firmly settle the ground in and around where your house is presently built. An **Older home**, of course, is defined as one that is more than ten years old.

When a house is being built, the ground is graded and tentatively landscaped. A regular rainfall throughout the year would help our houses to settle gradually. But this is not the case in New England. Due to our freezing temperatures here, some houses are built through a winter season and the foundation and building materials have not had the opportunity settle and go through a weather change as of yet. This means that if you move into your new house in February, you may not see any settlement activity (typically known as common wall and ceiling cracks) until the first major temperature change. Dry winter weather draws out most of the moisture from building materials, verses the summer which retains a lot of moisture. Our New England weather changes are what cause materials to shrink in the winter and expand in the summer. Settlement damage usually occurs after this temperature change. You might even consider it to be major settlement damage, even though it is common settlement damage, simply because it happened to

your house. Your first thought would be that your beautiful new home is now a wreck and collapsing around you as you sleep. This is not necessarily so.

If your home is a **Newer home** (less than ten years old) you might notice hairline cracks develop at both interior and exterior locations, particularly within the concrete foundation and door and window corners, and typically in a diagonal manner. Usually these are common concrete and drywall cracks. Sometimes the door and window cracks will follow the drywall seams, forming perfectly straight lines and 90° corners. When they follow drywall seams, they can appear anywhere, depending on the quality of the workmanship: how well the drywall sections were fitted together, whether or not seam tape was used, the quality of the seam tape, the type of nails or screws used to secure the drywall, the quantity of screws or nails used to secure the drywall, and the quality and thickness of the ceiling or wall texture.

Ceiling and wall texturing, and painting, prevent me from inspecting workmanship in order to determine why drywall seam cracks appear. If the house is more than ten years old, most settlement activity probably has already occurred, simply because it has been through several years of serious weather changes. This presumes many things in the older home, such as the house having been well-maintained by previous homeowners; fully functional gutters and downspouts in place; grading and drainage directing water away from the foundation; vegetation which has not been allowed to grow on the roof or siding, or too close to the foundation; and any leaks in the roof, plumbing, or drainage systems, as well as any damage from those leaks, having been repaired immediately to prevent additional damage, which sometimes might be concealed in the walls or ceiling. Those are a lot of presumptions, and typically not all of them are valid for any property.

Let me give you one last tip on older homes… ***Any type of renovation or remodeling of any section of an older home is going to uncover problems or defects which are not noted in your report, typically because they could not be seen or detected, especially in a furnished structure.*** Knowing this, you should budget appropriately for unexpected and unforeseen circumstances during any remodeling work that is in the planning stages.

K) Recalled Appliances

Massachusetts Home Inspections does not research product recalls or notices of any kind. A basic home inspection does not include the identification of, or research for, appliances and other items installed in the home that may be recalled or have a consumer safety alert issued about it. Any comments made in the report are regarding well known notices and are provided as a courtesy only. I recommend visiting the following internet site if recalls are a concern to you (**http://www.cpsc.gov/cpsclist.asp**). Product recalls and consumer product safety alerts are added almost daily.

The CPSC web site is very easy to use and has an on-line subscription service for notification of any recalls or safety concerns. There are many subscription choices, including subscribing to recalls involving only selected products, e.g., infant/child products, sports and recreation products, outdoor products, household products, and specialty products. There are literally thousands of recalls and safety concerns that have been released since the Consumer Product Safety Commission began operating in 1973, and they all are listed. Not all recalls and safety

concerns make the headlines of your local newspaper. Massachusetts Home Inspections recommends that you subscribe to all CPSC press releases, including recalls. This will alert you to all recalls and safety concerns of products on the market today.

L) Shutoff Valves, Circuit Breakers, Electric outlets and Gas pilots

Only a visual inspection of shutoff valves and circuit breakers is performed. I not only want you to be safe in your new home, I want to be safe while we are inspecting your new home. Therefore, I do not turn any water main valves or gas shutoff valves, move any electric circuit breakers to the "on" position, plug in anything that has been unplugged, or light any gas pilots, simply because I do not know why the valves or breakers were off, why the equipment was unplugged, or why the gas pilots were turned off. Turning valves and breakers on, plugging in equipment, or trying to light gas pilots without such knowledge can cause property damage, personal injury, and, in a worst case scenario, loss of life. I also do not do any of the opposite functions, i.e., turning water or gas shutoff valves off, moving electric circuit breakers to the "off" position, unplug anything that is plugged in, or extinguish any gas pilots.
Any circuit breakers that were in the "off" position are noted as such and are not switched to the "on" position. If breaker tripping problems are detected, you should seek the guidance of a qualified electrician, as circuits might be overloaded or a short might have been caused at an outlet or switch during the move-out/move-in process.

The function of the water heater TPR discharge pipe cannot be determined since it is connected to a valve; it is given a visual inspection only. Due to the constant pressure in the water supply lines and the lack of daily use of shutoff valves at the toilets, sinks, and water heater, the valves can fail at any time. Many sellers try to be helpful by turning off all the water shutoff valves at the toilets, sinks, and water heater as the last thing they do when they move out. This typically is exactly the wrong thing to do. In many cases the valves are very difficult to turn due to rust, corrosion, and/or mineral build-up from hard water, and when they are forced, they break and leak when they are turned back on. I recommend that you have qualified personnel inspect water shutoff valves at the main entry, toilets, sinks, and water heater before close of escrow to ensure proper operation. If you choose not to have the water shutoff valves at the main entry, toilets, sinks, and water heater inspected and tested before close of escrow, I recommend that you instruct the sellers to leave the water on at all water-using appliances, particularly if you are going to be moving in within a couple of days or so. If you intend to leave the residence vacant for any period longer than a weekend, please read the chapter titled "**Vacant Residence**."

M) Smoke & CO Alarms - Massachusetts law requires that all residential structures be equipped with approved smoke detectors and CO (Carbon Monoxide) detectors upon sale. The local fire department will issue a certificate to prove compliance. The Seller is responsible for obtaining this certificate before close of escrow. Your Realtor will go over this with you.

N) Bad Checks - If your check is returned due to insufficient funds or a closed account, you will be charged $35 for each occurrence, and you will be charged accruing interest each month until the debt is paid. You will be responsible for any fees (attorney or collection agency) needed to collect any fees that are due.

PART 2

EXTERIOR and GROUNDS

A) Taking Care of your House

The easiest way to take care of your house is to keep unwanted moisture away from the exterior, particularly the foundation, and out of the interior, particularly the attic, closets, and interior ceilings. This typically means little or **no** watering next to your foundation. This typically translates into **no** high-water-use plants next to your foundation. (What's a high water-use plant? Typically they are big plants, tropical plants, and plants that have large foliage or lots of flowers.) I recommend **regular monitoring and maintenance** of the exterior roof, walls, and foundation to include the structural and mechanical components attached to them and all interior walls and floors under any upper stories.

What is… regular monitoring and maintenance?

Home ownership! It's not easy being a homeowner, and there will be many things that become problems while you own your home in which you will need to spend money to resolve. I recommend proactive preventive maintenance rather that after-the-fact reactive repair. To that end, throughout my inspection report you may read certain recommendations of homeowner monitoring and maintenance." This means that things will fall apart or become problematic if you don't take care of them. Some items will need to be monitored and maintained Daily (plumbing fixtures, basement, etc.), Monthly- (GFCI outlets, etc.) or annually (roof, water heater, fireplace, gas-using appliances, etc.). You're investing a substantial amount of money in a home. Please take care of it or hire professional service contractors to take care of it for you.

B) Grading and Drainage

Grading and drainage are probably the most significant aspects of a property, simply because of the direct and indirect damage that moisture can have on structures. More damage has probably resulted from moisture and expansive soils than from most natural disasters, and for this reason I am particularly diligent when I evaluate site conditions. In fact, I compare all sites to an ideal. In short, the ideal property will have soils that slope away from the house (not towards) and the interior floors will be at least several inches higher than the exterior grade. Also, the house will have gutters and downspouts that discharge into area drains with catch basins that carry water away to hard surfaces.

If there are no gutters in place, rainwater heads right for the weeping tile around the basement and can overload your foundation drainage system causing a flooded basement. The land around many homes settles over time, and then slopes in toward the foundation. If your lot slopes inward, you'll want to fill in and grade the lot so that, for at least 6 feet out from around the foundation, the land slopes away from your house.
If a property does not meet this ideal, or if any portion of the interior floor is below grade, I will not endorse it, even though there may be no evidence of moisture intrusion.

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I have discovered evidence of moisture intrusion inside homes when it was raining that would not have been apparent otherwise. I recommend that you consult with a grading and drainage contractor. Please read "Foundations" Part 5, to which I have explained in more detail about perfect Exterior conditions.

C) Exterior Grounds (Winter)

Any snow accumulation on the day of your home inspection will prevent me from inspecting the Exterior components. Roof surfaces, grading, drainage, exterior surfaces and components cannot adequately be inspected during winter snow accumulation. I recommend inspecting these components during the first snow clearing to determine the conditions. Visible portions of the Roof, topography and landscaping, retaining walls, fences and gates, driveways and walkways, exterior stairs, porches and patios, decks and balconies, and guardrails and handrails appeared functional at the time of the inspection unless noted in Section "Exterior and Grounds" of your home inspection report.

D) Roofs

There are many different roof types, and every roof will wear differently relative to its age, the number of its layers, the quality of its material, the method of its application, its exposure to direct sunlight or to other prevalent weather conditions, and its maintenance. However, regardless of its design-life, every roof is only as good as the waterproof membrane beneath it, which is concealed and cannot be examined without removing the roof material, and this is equally true of almost all roofs. In fact, the material on most pitched roofs is not designed to be waterproof, only water-resistant.

There are two basic roof types, pitched and flat. Pitched roofs are the most common, and the most dependable. They are variously pitched, and typically finished with composition shingles that have a design life of eighteen to thirty years (depending upon quality and environment), or wood shakes/shingles that have a design-life of forty to fifty years, and roll roofing that have a lesser pitch and a shorter design-life of ten to fifteen years. These roofs may be layered, or have one roof installed over another, which is common practice but one that is never recommended because it reduces the design-life of the new roof by several years and requires a periodical service of the flashings. These are serviced with mastic, which eventually shrinks and cracks and provides a common point of leakage if not properly maintained.

However, among the pitched roofs, roll roofing is the least dependable, because the low pitch prevents them from draining as readily as other roofs. For this reason, they must be conscientiously maintained. In this respect, the least dependable of all roofs are the flat ones, which are also called built-up ones. Rubber roofs are becoming the ultimate material for flat roofs today, as they have a life expectancy of 25-30 years. Some flat roofs are adequately sloped toward drains but many are not, and water simply ponds and will only be dispersed by evaporation. However, the most common cause of leakage results when roofs are not serviced or kept clean, and foliage and other debris blocks the drainage channels.

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What remains true of all roofs is that, whereas their condition can be evaluated, it is virtually impossible for anyone to detect a leak except as it is occurring or by specific water tests, which are beyond the scope of my service. Even water stains on ceilings, or on the framing within attics, will not necessarily confirm an active leak without some corroborative evidence, and such evidence can be deliberately concealed. Consequently, only the installer can credibly guarantee that a roof will not leak, and most do.

Massachusetts Home Inspections cannot, and does not give any such guarantees. I will examine every roof, evaluate it, and even attempt to approximate its age, but I will not predict its remaining life expectancy, nor guarantee that it will not leak. Naturally, the sellers or the occupants of a residence will generally have the most intimate knowledge of the roof and of its history. Therefore, I recommend that you ask the sellers about it, and that you either include comprehensive roof coverage in your home insurance policy, or that you obtain a roof certification from an established local roofing company.

E) Shingles

There are a wide variety of composition shingle roofs, which are comprised of asphalt or fiberglass materials impregnated with mineral granules that are designed to deflect the deteriorating ultra-violet rays of the sun. These roofs are warranted by the manufacturer to last from twenty to thirty years, and are typically guaranteed against leaks by the installer for three to five years. The actual life of the roof will vary, depending on a number of interrelated factors besides the quality of the material and the method of installation. Poor maintenance is the most common cause of roof failure, but a southern exposure can cause a roof to deteriorate prematurely, as will the practice of layering over another roof.

However, the first indication of significant wear is when the granules begin to separate and leave pockmarks or dark spots. This is referred to as primary decomposition, which means that the roof is in decline, and therefore susceptible to leakage. This typically begins with the hip and ridge shingles and to the field shingles on the south facing side. This does not mean that the roof is ready to be replaced, but that it should be serviced or monitored. Regular maintenance will certainly extend the life of any roof, and will usually avert most leaks that only become evident after they have caused other damage. This is important because in accordance with industry standards, my inspection service does not include a guarantee against leaks. For such a guarantee, you would need to have a roofing company to perform a water test and issue a roof certification. However, the sellers or the occupants will generally have the most intimate knowledge of the roof; I recommend you ask them about its history.

F) A Roof over your Head

Here's how to protect your investment without spending a lot of money and waiting until thousands of dollars worth of damage occur to the interior because of a roof leak. Put in your annual home maintenance budget a couple of hundred dollars or so for a roofing contractor.

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Every October when you set your clocks back (or any other easily remembered day in the Fall, but definitely before the winter season), pay a qualified roofing contractor to come out and examine your roof and give it the A-OK (some roofing contractors may also provide warranties against leaks for a year or two). Now you should make it through the winter season with no problems. And a couple of hundred dollars or so in preventive maintenance for the roof is much better than waiting until it leaks and going through the anguish of a major roof leak, damage to the structure interior and furniture, and possible damage to your books, pictures, photographs, and other priceless mementoes of you and your family.

Your roof covering will last a long time in our New England climate if you'll do three things: make sure your attic has (1) adequate ventilation (Read Part 2-I) (e.g., any combination of gable, soffit, ridge, drip edge, turbine, roof vents; and attic fans), (2) verify adequate insulation in attic, floor and walls, and (3) give a roofing contractor a couple of hundred dollars or so each year, or toward the end of whatever warranty period the roofing contractor provides you, to inspect your roof and flashing.

Some simple tips to follow in order to keep your roof in great shape…

- Clean all debris from the surface of the roof. This includes debris that has gathered behind HVAC units, pipes, chimneys and any other roof penetrations. Debris has a tendency to hold water, and water will expedite roof deterioration, especially if your roof is asphalt based such as a built-up roof or asphalt shingles.
- Keep algae off of the roof surface. If your roof is starting to collect moss or algae, install several zinc or lead control strips along the hips and ridges of the roof, if necessary.
- Check all roof flashings and make sure that they are not deteriorated and there are no holes or gaps in them.
- Dab some roof cement under any loose or lifting shingle tabs. One dab on either side should do.
- Replace any damaged shingles.
- Keep all gutters free of debris. Make sure that the downspouts are draining properly by water testing them and checking flow and observe all seams for leakage. See Section 2-B.
- Trim back any overhanging tree branches from the roof area.
- Check all caulking and sealants. Scrape and remove any caulking that is weather cracked and damaged. Clean the area thoroughly. Use a wire brush if necessary. Reapply a polyurethane caulking such as Vulkem, NP-1, or equivalent.
- Check the mortar on chimneys and parapet walls, both in between the brick and on top. If it's damaged or deteriorated, have it parged or tuck-pointed. Any mason can perform this work.

G) Chimneys

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There are a wide variety of chimneys, which represent an even wider variety of interrelated components that comprise them. However, there are three basic types: single-walled metal, masonry and pre-fabricated metal ones that are commonly referred to as factory-built. Single-walled metal chimneys should not be confused with factory-built chimneys, and are rarely found in residential use, but masonry and factory-built ones are a commonplace.

My inspection of chimneys is that of a generalist not a specialist, and meets industry standards. However, significant areas of chimney flues cannot be adequately viewed during a field inspection, as has been documented by the Chimney Safety Institute of America, which reported in 1992: "***The inner reaches of a flue are relatively inaccessible, and it should not be expected that the distant oblique view from the top or bottom is adequate to fully document damage even with a strong light***." Therefore, because my inspection of chimneys is limited to those areas that can be viewed without dismantling any portion of them, and does not include the use of specialized equipment, I will not guarantee their integrity. I recommend that they be video-scanned before the close of escrow.

H) Chimney Flues

Chimney flues need to be cleaned periodically, to prevent the possibility of a chimney fire. However, the complex variety of deposits that forms within the chimney flues as a result of incomplete combustion, and which contribute to such fires, are complicated and not easily understood. They range from soot or pure carbon that does not burn, to tars that can ignite. All of these deposits are commonly described as creosote, but creosote has many forms, ranging from crusty carbon deposits that can be easily brushed away, to tar-glazed creosote that requires chemical cleaning. These deposits must be identified and treated by a chimney specialist. However, cleaning a chimney is not a guarantee against a chimney fire. Studies have proven that a significant percentage of chimney fires have resulted within one month of the chimney being cleaned and many more have resulted within a six-month period.

It is impossible for Massachusetts Home Inspections to determine with any degree of certainty whether all flues are free of defects. In accordance with recommendations made by the National Fire Prevention Association to have all chimneys inspected before buying a home, you should consider having a C S I A, or equivalently certified chimney sweep, conduct a Level II inspection of all chimney flues prior to close of escrow.

I) Roof Venting

Proper roof venting is critical to good construction practices and maintenance. The purpose of roof venting is to reduce temperature build-up inside the roof cavity during the summer months and to reduce fungal wood rot and other problems associated with condensation in the roof cavity during the winter months.

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A good venting system allows for a continuous flow of air which enters the roof cavity at a low spot in the roof (for example, under the eave) and exits the roof at a high spot (for example, at or near the ridge of the roof). As a general rule, there is no need to provide for any sort of mechanical assistance, fans, or other devices to the roof venting system. A good venting system works adequately by means of a natural convection current where warm air rises and pulls the cooler, drier air behind it. A good roof venting system must also be designed in such a way as to provide for proper air flow at all portions of the roof. Improperly vented roofs often result in premature deterioration of the roofing material and fungal wood rot in the roof framing and sheathing.

It is not uncommon to find an improperly vented fifteen-year-old roof with badly curled (and thus non-functional) roofing material and advanced fungal wood rot on the lower side of the roof sheathing. With the introduction of more insulation and weather sealing, as well as other building techniques which reduce venting, proper roof venting techniques are even more critical than in the past.

Most importantly, never cover up your vents in the winter as this the most important time proper ventilation is needed. If you feel cold air coming into your living area from your attic, it's possible that more insulation is needed on the floor surface of the attic and at the interior access opening. Again, do not cover the attic vents and keep all of the attic vents screened to prevent insects and rodents from gaining access.

J) Trees around your Home

Trim all trees, shrubs and vines periodically, so the branches do not touch or come close to your house siding or roof surface. Sun needs to dry out those hidden moist areas. Branches also provide wood boring insects an easy path to your home. Wood boring insects also thrive on dead wood. Remove any tree stumps and dead trees within 50 feet of your foundation and store firewood off the ground and away from your home.

At the same time you want a safe home. Don't let your shrubs and trees provide cover. Cut back tall shrubbery near doors and walkways as well as plantings that block windows. Try to keep your plantings trimmed to a height of 3 feet or less. Also trim any trees or shrubs that block the view to neighbor's homes. Privacy issues aside, you want your neighbors to have a clear view of your home's doors and windows.

K) Driveway/Walkway maintenance

Concrete

Repairing cracks and holes in concrete prevents water damage and improves safety. These cracks can allow water to travel into areas where it isn't invited. Concrete is also quite porous and acts like a sponge. When temperatures drop and concrete is wet, it can freeze, causing cracking and spalling or chipping. You can minimize this damage by periodically sealing the concrete with an acrylic or silicone-based concrete and masonry sealer.

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A liquid concrete sealer prevents water absorption by filling the pores of the concrete. Generally clear, a concrete sealer lasts for six months to a year depending upon the quality of the material, surface preparation, and the climate.

Inexpensive "water seals" don't offer the level of protection that some of the more pricey products do. Moreover, poor-quality sealers need to be applied more frequently and can end up costing more money in the long run. Concrete sealers can be applied with a brush, roller, or by using a pump garden sprayer. Before you begin, the concrete should be clean. Rock salt used to melt snow is another primary source of deterioration of concrete. Sealer can also help protect the concrete from salt damage. After the snow melts, rinse the area with hot water to remove the majority of salt deposits.

Asphalt

Blacktop driveways don't remain smooth and black forever. The forces of New England weather does its best to break down the surface. Unless your driveway is adequately maintained, cracks and potholes will appear. Grass can take over the edges and work its way through developing cracks.

Excessive heat, freezing grounds, ultraviolet rays and substances such as salt, oil, gas and grease all take their toll. Without protection, that beautiful black driveway eventually can become a lumpy, crumbling mess. If you are willing to put forth a little effort, you can prevent these problems by sealing coating your driveway every two to three years.

L) Retaining Walls

There are many different materials that are used for retaining walls. There's stone, ledge rock, brick, broken concrete, concrete blocks and railroad ties. Most of these retaining walls provide support for soil that is on a vertical slope. Most walls literally keep your home and landscape from sliding down a hillside. Other times walls are necessary to prevent drainage or erosion problems. For whatever purpose these walls are serving, these special structures are relatively expensive and deserve careful attention to protect your investment. Retaining walls should be carefully checked periodically, for shifting, bulges, or loose structural material. If you notice that your wall has loose material, I recommend that you repair or protect these areas right away. If you see that your wall is becoming displaced, contact a landscaper right away before this worsens.

Make sure that all the lower footings are protected from erosion. Also look for weep holes at the lower portion of your wall. Weep holes are exposed holes with piping that penetrate the retaining wall and assist in draining the area immediately behind the wall. Weep holes should have a minimum diameter so as to permit free drainage; for large walls, 4-inch weep holes are common. Adequate spacing between weep holes allows uniform drainage from behind the wall. Drainage lines are often perforated and wrapped in geotextile or buried in a granular filter bed, and serve to carry water to the weep holes from areas deeper within the backfill.

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If your property has ***solid walls*** and these weep holes are not visible, I highly recommend that you have a professional landscaper install these as soon as possible to prevent water retention which in turn, causes serious heaving of the wall. If you have ***landscape timber walls*** (railroad ties), I recommend that you probe these walls periodically for hollow areas. Carpenter ants and wood rot tend ruin these walls over the years and require replacement because they become very weak. If you are planning to replace a ***wood retaining wall,*** I recommend replacing the material with stone, brick or other masonry material for a longer lasting wall.

M) Deck Maintenance

Your deck is a valuable asset to your home. Its surface is constantly exposed to our weather extremes causing the wood to crack, fade, split, cup and warp. The majority of decks in New England are made from pressure-treated pine. Although pressure-treated wood resists insects and decay, it's still vulnerable to moisture, freezing and the sun's rays. The same applies to other exterior woods including Cedar, Cypress and Mahogany. To keep it looking new and lasting longer, a regular maintenance treatment system is necessary.

Approximately once a year, your deck should be checked for loose balusters, boards and protruding nails, thoroughly cleaned, and resealed. Take the time to examine all the wood carefully, to see if any boards have rotted. Unfortunately, most wood rot occurs in places that are hard to see…under the decking boards, at the ledger (the board that is attached to the house), on the underside of stair treads, and the exposed end grains of all decking. If possible, crawl underneath the deck to make your inspection. If your deck has wood posts or stair stringers that penetrate the dirt, probe the bearing ends for rot. Replace if necessary and this time use concrete footings to separate the wood from the dirt.

Cleaning involves the removal of dirt, algae, moss, and other organic matter. In accordance with the directions that come with the cleaning solutions, it may be necessary to hose down the deck and surrounding area before applying cleaning solutions. The water will also help dilute any chemicals that may inadvertently come into contact with surrounding plants and grass. Even with mild solutions, care must be taken to limit the amount of solution that gets on nearby plants and grass. Many cleaning solutions contain bleach, which is toxic to plants when in concentrated form. The solutions can be brushed onto the deck using a broom or can be sprayed on with a power washer under low pressure.

You can also give your wood surfaces (oiled, oil-stained, or painted) a good scrubbing using the following home-made formula…

- 1 cup of powdered laundry detergent
- 1/2 cup liquid chlorine bleach (if moss is present)
- 1 gallon of hot water

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- After waiting the directed length of time for the chemicals to do their work, the deck should be thoroughly rinsed. This is the step where more power can be particularly helpful, as water under pressure more effectively rinses out both dirt and chemicals.

However, too much pressure can gouge wood or cause the grain to become exaggerated. Within wood, the visible grain marks differences in density and hardness. Part of each grain is relatively soft wood. This softer wood can be gouged if too much pressure is used. At still higher pressures, even the harder parts of the grain can be damaged. Do not get too close to any wood when using a pressure sprayer.

Sealing

If you plan to refinish the wood after cleaning, allow the wood to completely dry before applying the finish. Once dry, resealing is accomplished by applying a clear or semi-clear liquid sealant to all exposed surfaces. Homeowners can do any of these tasks themselves, but often don't do them as well as a professional.

Staining

If you plan on staining your deck, look for a Stain that is designed specifically for decks. Well-meaning do-it-yourselfers often end up applying stains designed for vertical surfaces, such as siding. Stains designed for use on vertical surfaces are not as abrasion resistant as those made for decks. Deck stains are made to resist scuffing where lots of traffic is expected. Always apply an oil or oil-stain finish either early or late in the day when the wood is not in full sun. The thinner that helps the oil penetrate evaporates too quickly on hot days. The oil can end up laying on the surface. Then help to force the oil or oil-stain into the surface by going back over the entire area with a paintbrush or roller (called back brushing).

Alternatives to Traditional Decking Materials

If you do not have time to maintain a traditional wood deck, there are now new decking material options. Several companies are now producing new composite decking materials that are resistant to rot, do not warp or splinter, maintains its shape, does not shrink or expand and doesn't require periodic staining. Most are made of recycled plastic or a blend of wood and plastic called Composite Decking, also known as Trex Decking.
Composite decking weathers, like wood, but will age to an even tone without deteriorating. Composite decking does lack the strength of wood, however, and wont span the same distances as wood. With appropriate structural support, composite decking is well suited to first floor and above ground decks. Plastic structural beams are not readily available in all markets and tend to make the deck bouncy, so pressure-treated wood is most commonly used to support this type of decking.
While widespread experience with this product is just now occurring, results look very promising. This material is more expensive initially than the common wood products used today, but they offer large savings over time due to their low-maintenance.

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LIVING SPACE

A) Home Inspectors as Movers

There are times where I get asked why I didn't move something during the course of my inspection. Insurance concerns are my main reason. I do not know how much an item might have cost its owner, or the special history of any item, so my insurance precludes me from moving something and possibly damaging it. Even the unlikeliest-looking item could be a priceless heirloom, or a priceless heirloom could be in that common cardboard box. Additionally, if I were to move only one item, case law would require me to move every item. Obviously, time constraints preclude me from taking on that role. Home inspectors are not movers, and I do not know of any movers who are home inspectors. These are two vastly different professions.

B) Blame the Home Inspector

Home inspectors get blamed for a lot of mishaps, especially when the residence is occupied and fully furnished or when the residence is vacant and unfurnished; in other words, all the time.

A home inspection is a visual inspection of the structural and mechanical components. A furnished home presents problems for inspectors because many areas typically are not visible due to floor and wall coverings (carpet, tile, area rugs, wallpaper, paneling, etc.), furnishings, storage, packed moving boxes, wall hangings and mirrors, etc. Use of electric outlets typically prevents the testing of every electric outlet because I will not unplug equipment that belongs to someone else to test any receptacles. Interior furnishings and storage typically prevent me from accessing, inspecting or opening every single window, cabinet, closet, or door, but I will do my best to access most areas.

Here's what typically happens with occupied and fully furnished residences. Since the residence is being lived in and systems are being used on a daily basis, it is possible that something will be damaged or fails during the escrow period and during the move-out/move-in process, especially when children are present. Homeowners rarely damage something during escrow and file a claim against their homeowner's insurance policy because, hey, they think it's not even their home anymore. They think you own it. Why should they fix something that belongs to you? Some sellers actually do not understand (or do not care) that they still own the home during the escrow period and should continue to take care of it.

Selling a home and leaving is a stressful event. To help relieve that stress, sellers and buyers typically have "moving parties," "last parties," "first parties," or "housewarming parties." Or they move hurriedly so they don't have to take too much time off from work or use up vacation days or sick leave. The actual days of moving are when most post-inspection damage occurs, and usually it is by the guests (or movers) helping the owner

(seller or buyer) move, so the owner may not even know anything about the damage that has occurred. In both these instances, sellers like to say, "Your home inspector must not have seen that." Buyers like to say, "Our home inspector missed that."

Here's what I do know: Windows and window screens, and doors and door screens, are easily damaged during the escrow period and during the move-out/move-in process. Lights, switches, outlets, etc., can be damaged or fail. Because of the location of water supply and drainage pipes in our sink cabinets, where we start cramming things immediately upon move-in, plumbing pipes are easily damaged during the escrow period and during the move-out/move-in process, possibly causing loose pipes and leaks. Lights, wall switches, and outlets (electrical, telephone, and cable) get a lot of use during the escrow period, during the move-out/move-in process, and for those various parties, and thus are easily damaged. In other words, by the time the buyer is completely moved in, there could be anything that just isn't right or isn't the same as it was on the day of the inspection. That, of course, is the nature of real estate.

So how do you remedy all this post-inspection damage?

C) A Final Walk-through

I believe the purpose of your final walk-through is not only to make sure that any requested items have been repaired, but also to make sure that additional damage, deterioration, and destruction beyond normal wear and tear has not occurred. I recommend a careful, slow, and thorough observation with your Realtor at your final walk-through to ensure your satisfaction. Do yourself a favor, after you have had your own moving parties, walk around your home and check for damage caused by your guests. You're very likely to find some; in many instances, your guests may not even know that they caused damage.

D) Interior Cracks

Common cracks are typically, but not always, defined as hairline cracks less than one-eighth inch wide or less than twelve inches in length. Almost by definition, concrete drywall and stucco will crack, simply because the material shrinks and cracks as it dries, cures, and ages. Common cracks in these materials are also called shrinkage cracks. Common cracks can appear at any time in the life of a structure, typically running diagonally from door and window corners where they typically are of least concern.

Major cracks are typically defined as more than one-eighth inch wide, more than twelve inches in length, excessive in number, unusual (stair-step, V shaped, straight horizontal, or straight vertical), or in unusual locations (such as middle of a wall with no doors or windows nearby). If major cracks are present or appear, you should seek additional evaluation from a qualified structural engineer specializing in foundations and structures. Some major cracks occur simply due to neglect and ignorance about how to take care of common cracks. In other words, a common crack can become a major crack if it is ignored.

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Cracks and areas around all cracks should be repaired and monitored on a regular basis, especially during periods of rain and freezing weather and any additional damage should be evaluated by a qualified civil engineer. If you are unfamiliar with common cracks, you should seek the specialized services of a qualified structural engineer for further evaluation and information. Major settlement cracks, particularly in the foundation, walls, ceilings, and/or attached porches/patios, should be inspected BEFORE CLOSE OF ESCROW to help protect your investment in this piece of real estate. Major settlement cracks in driveways, walkways, and other areas typically are more cosmetic than of a critical failure nature but should still be evaluated by a qualified professional. I recommend repair and/or replacement of affected components and regular monitoring and maintenance to seal and weatherproof cracks to help prevent additional damage and accelerated deterioration.

Although you might be willing to accept a house with more than its fair share of common and major cracks in various areas, the person who seeks to purchase your house somewhere down the road may not be so accepting, thereby leaving you to make repairs then, at which time additional damage might have occurred due to ongoing neglect. It is in your best interest to take care of both common and major cracks now.

Improving your Homes Energy Efficiency

E) Installing Insulation

Read through the insulation manufacturer's instructions before you start. Skipping steps and taking shortcuts could mean significant reductions in R-value — and a waste of your money and effort.

Allow yourself plenty of time and make sure you have enough materials to complete the job. If you're using rolled blankets of insulation, DO NOT open the package until you've hoisted it into the attic – the material will expand significantly, making it much harder to handle.

Always wear goggles, a dust mask or respirator, gloves, long sleeves and long pants when working with insulation.

Be very careful moving around in your attic. Watch out for overhead rafters and sharp nails protruding through the upper roof backings, and walk only on floor joists or sturdy floor boards — if you try to walk between floor joists, your foot will fall right through the ceiling below. If you have room, lay a plywood panel across floor joists to walk or kneel on.

Step 1

Make sure you'll have adequate ventilation before the new insulation is in place. Never cover attic vents, and leave at least one inch of airflow between the insulation and the roof. If ventilation is lacking, I recommend a roofing contractor install additional roof vents on the high side of the roof and lower soffit vents with Styrofoam baffles between

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the interior rafters leading to the soffit area in order to retain the air flow. They're inexpensive and easy to install – just staple them in place.

Never cover attic vents with insulation. If your roof cavity does not contain attic vents, be sure to add several before installing new or additional insulation — your contractor or retailer can advise you on what's best for your situation.

Step 2

If you purchased "unfaced" insulation, you'll need to install a vapor barrier to prevent moisture damage. You can use pre-packaged vapor barriers or use 4- or 6-millimeter polyethylene sheeting. Vapor barriers should always go towards the warm side of the house. For attics, it needs to go under the insulation.

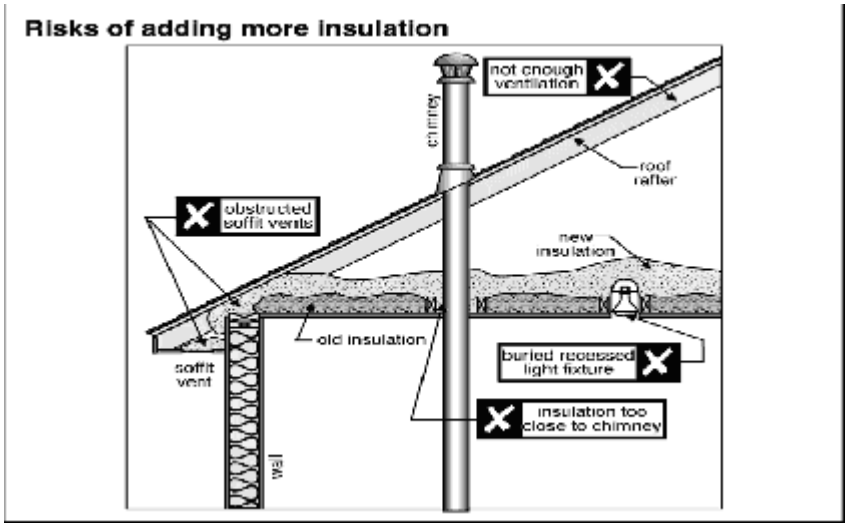
If you purchased insulation with a Kraft-paper or foil facing, the barrier should be placed down toward the inner ceiling – but only the first layer. On second or third layers, cut slits in the vapor barrier to allow moisture to pass through or just purchase un-faced blankets for any top layers.

Step 3

Look for electrical fixtures that protrude through your ceiling, especially recessed lighting. Since these fixtures can become hot when in use, you need to keep insulation a safe distance away from these fixtures to prevent heat build-up. Use a 1" x 4" or 1" x 6" piece of wood to create a retaining wall on either side of the fixture. Keep the insulation at least three inches away from the fixture.

Step 4

If you're adding loose-fill insulation, it's imperative to distribute it evenly across the attic area. Any gaps, holes or inconsistencies in depth will decrease the R-value. The goal for New England's Weather is 12-14 inches of blanket insulation or 8-9 inches of loose-fill insulation equaling an R-39 value. If you're using batts or blankets, use your utility knife to cut pieces to size. Place any second and third layers at right angles to the lower layer. This technique will help to lock in the thermal barrier.



PART 4

HEATING

A) Types of Heating

Depending upon where you live and how your house was built, your home may have any of several different types of climate systems that help you to enjoy your interior spaces year-round. Forced-air and Forced-hot water heating (fueled by gas, oil, or electricity) are very common types of heating here in Massachusetts. Other types of heating include Steam, Radiant and Electric baseboards.

Furnaces, Boilers, Electric baseboards and radiant heating systems can be unique in their operation and maintenance. The examination of your heating and cooling systems is mechanically limited since the units are not dismantled to examine interior components. All heating and cooling appliances, including electric baseboards and radiant heating systems are tested by operating the thermostat or controls as a user would normally operate them on a daily basis. Gas shutoff valves are not tested.

Your heating equipment should be inspected and serviced on an annual basis. Before close of escrow, I recommend obtaining from the Seller any documents concerning regular maintenance and service and a safety check by public utility, or a complete system evaluation by a qualified heating specialist, particularly if heating components cannot be proven to have been inspected within the past twelve months. Utility companies typically, but not always, provide a free safety check of all gas-using appliances.

B) Forced Air Systems (Hot and Cool)

In a forced **Hot** air heating system, the heat exchanger in a furnace is warmed by burning fuel. A blower fan circulates air from inside the home over the warm heat exchanger. This warmed air is then circulated throughout the building. This process heats the home.

In some homes, forced hot air heating ducts are also used for Central air conditioning, which is an electric powered split-system. The two prime components of the system include the compressor unit and the evaporator unit. (***Notice: The outside compressor unit has an average twelve to fifteen year service life with proper maintenance***.) The heaviest, noisiest, heat-shedding components--the compressor and condenser coil, are installed outdoors, while the evaporator coil is installed indoors, usually in the form of an A-frame in the plenum of the forced-air furnace. In this case, the furnace's blower moves the interior warm air over the coils and distributes it into a chilled air.

Two refrigerant lines run between the compressor and evaporator. The larger line (vapor line) should always be insulated to maintain temperature and prevent it from sweating. A condensate drain line runs from the indoor evaporator to a drainage point. This drain line may be connected to a device called a condensate pump if the installation elevation

requires lifting the condensate to an outside drain. The central air conditioning system shares the same duct distribution system, blower unit & filter, as the heating furnace to deliver cool conditioned air to the habitable rooms serviced by the system.

One of the most important things you can do to maintain your forced air furnace and keep it running smoothly and efficiently is change your air filters on a regular basis. Once every two to three months is about right and you will prolong the life of your Furnace and improve the quality of your indoor air as a result. As you put in the new filter, make sure to have the arrows pointing in the direction of the air flow (towards the blower). Just remember, the air flows into the return duct towards the blower compartment. Disposable filters are recommended, but you may utilize a washable filter made of steel or soft mesh.

At the start of each heating season, open the blower compartment of your heater and make a visual inspection. Gently scrape the dust and grime off the blower blades with a screwdriver or putty knife. Most modern blower motors are sealed and self-lubricating. But if you have an older system, the motor may have an oil reservoir. If so, you should fill it at the start of the heating season.

B1) If you have a gas furnace, a professional tuning and cleaning every two years is a good idea. Electric furnaces should be professionally inspected every two years and for oil furnaces; it's a good idea to schedule a tuning every year. I highly recommend that you request your HVAC technician to inspect the Heat Exchanger for cracks, holes or leaks as my inspection is mechanically limited since the furnace requires dismantling to examine this particular area. A deteriorated heat exchanger will allow deadly products of combustion into your living area.

C) Boiler Systems (Forced Hot Water)

In boilers, water is heated, usually to between 160 and 180 degrees Fahrenheit. Pumps circulate the hot water through pipes in the building. This heated water warms radiators or baseboards that are installed in the rooms. These radiators and baseboards, in turn, warm the air in the room. Boiler systems need regular maintenance to keep them operating efficiently. There is a danger of scalding or steam burns when working around a boiler system, so any maintenance should be left to the plumbing professionals.

I recommend that you have your boiler serviced annually to maintain proper efficiency. Some older circulating pumps require periodic oiling at the small ports on top of the pump itself. If your boiler is equipped with these older pumps, verify that your plumber is oiling these ports. Routine annual inspection and cleaning by a qualified, licensed heating contractor keeps your hot-water system running for many years without trouble.

A dirty, inefficient boiler costs you far more than the service call. The serviceman catches little problems before they become big trouble. And a neglected system fails years sooner than a well-maintained one. Annual service keeps the system running properly and heads off most problems. You should also keep an eye on the system to make sure that all is well between inspections.

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D) Boiler Systems (Steam)

Steam heat is an older style heating system, typically installed in buildings constructed before the 1950s. Water is heated in a boiler in a similar manner but does not utilize any circulating water. The boiling water is heated until it becomes steam. Steam, which is a gas, rises through the pipes into the radiators. The steam causes these radiators to become hot. These radiators then warm the air in the building.

Most steam boilers need water added every week during the cold weather periods of winter. Some steam boilers have automatic water fill valves that will automatically add water when the water level becomes low. If your boiler fails to start when the thermostat is calling for heat, it could be the result of the low water cut-off valve shutting the system down due to an insufficient water level. Check the glass tube on the side of the boiler. Make sure that there is a sufficient water level. If not, add water to boiler until the tube water level reaches ¾ from the top. Never overfill this tube as water will start exiting from air vents and radiators. What a terrible mess this will turn out to be.

Your Steam boiler will also need a weekly draining to keep sediment from building up inside and potentially blocking or clogging the interior components. I recommend draining approximately 2 gallons of water or until the exiting water begins to clear up. Be Careful as this water is very hot.

E) Radiators

Radiators usually aren't the most attractive element in the room, so most people try to disguise or hide them. But this can significantly reduce the amount of heat that reaches the room. Air needs to circulate underneath the radiator, so avoid pushing furniture up against the radiator or covering it with draperies. If you like to have a shelf or cabinet around your radiator, make it easy to remove during the heating season. If you paint your radiator, be sure to use the right type of paint - choose one that's made specifically for "high-heat" applications. Otherwise it may crack or peel within a few days. Keep in mind that multiple layers of paint can also cut down on the amount of heat that reaches the room.

There is an easy way to improve the efficiency of your radiators - just add a reflecting panel behind it. You can purchase them at a home center or hardware store, or you can fashion your own with a piece of plywood and smooth sheets of aluminum foil. If you feel that a certain radiator makes a room too hot, you can shut it down completely by turning the control knob on the lower end of the radiator or just turn the bleed valve that is located on the upper side (if equipped) in order to lower the temperature itself.

F) Heat Pumps

Essentially, a heat pump is an air-conditioner working in reverse. In the summer, a heat pump functions like a normal air-conditioner when the temperature is above 65 degrees Fahrenheit. *(Use of A/C mode at colder outside temperatures could damage your compressor).* In the cooler months, the heat pump can be operated in a reverse mode.

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In this reverse mode, the heat pump heats a building by extracting the available heat energy from the outside air or underground water. Heat pumps are most effective at saving energy when in the heating mode. The problem with an air-source heat pump in a cold climate, however, is that your household needs more heat as the temperature outside goes down-- but the heat pump works less efficiently at lower outdoor temperatures. Below a temperature known as the "balance point," normally from 30 to 45º F, supplementary heat is required and that means expensive electrical-resistance heating kicks in. In this mode, the heat pump can be quite expensive to operate.

Heat-pump performance will deteriorate without regular maintenance and service. The difference between the energy consumption of a well-maintained heat pump and a severely neglected one ranges from 10 to 25 percent. Always make sure you turn the power on at least 24 hours before using A/C or Heat pump. Never cycle quickly between the two operating modes as this could damage your system.

G) Regular Maintenance

Either the homeowner or service technician can perform the following routine maintenance tasks:

- Clean or replace filters regularly (every 2 to 3 months, depending on operating time and amount of dust in the environment).
- Clean outdoor coils as often as necessary (when dirt is visible on the outside of the coil).
- Remove plant life and debris from around the outdoor Condenser.
- Clean evaporator coil and condensate pan every 2 to 4 years.
- Clean the blower's fan blades.
- Clean supply and return registers and straighten their fins.

Professional Maintenance

You should have a professional technician service your heat pump every year. The technician can:

- Inspect ducts, filters, blower, and indoor coil for dirt and other obstructions.
- Diagnose and seal duct leakage.
- Verify adequate airflow by measurement.
- Verify correct refrigerant charge by measurement.
- Check for refrigerant leaks.
- Inspect electric terminals, and if necessary, clean and tighten connections, and apply nonconductive coating.
- Lubricate motors, and inspect belts for tightness and wear.
- Verify correct electric control, making sure that heating is locked out when the thermostat calls for cooling and vice versa.
- Verify correct thermostat operation.

PART 4

Periodic Maintenance

Motorized equipment, like your heating system, requires regular adjustments, burner cleaning, parts replacement, repairs, venting inspection, and other checks. Licensed experts know your equipment and the necessary codes to follow. Your heating contractor can help make your equipment operate with peak efficiency, last longer, and save you money year after year. Having an annual service plan in place will also guarantee you an on-call 24 hours a day service technician to arrive at your house in case of a heating emergency.

H) Hearth Appliances

Some homes have wood-burning stoves, coal-burning stoves, or fireplaces. While a stove or fireplace can warm a building, it cannot be counted on to provide continuous heat. All of these systems require that the fuel be replenished on an ongoing basis. While this may suit a quiet getaway weekend in the country, it is seldom a match with modern lifestyles. Depend upon a wood-burning stove, coal-burning stove, or fireplace only as a ***supplemental*** source of heat.

It is best to burn only seasoned wood for maximum heat release, less creosote buildup, and economy. Avoid burning green (unseasoned) wood which may contain up to 50% of its weight in moisture and needs to be burned off before the heat can reach your house.

Stovepipes and chimney flues should be inspected by a chimney professional each year before you use your stove. They should check for all signs of deterioration such as cracked flue liners, leaks, warping, baffle gaps, broken or missing bricks, heavy creosote deposits, bird nests and other foreign material. Thoroughly clean the flue and stovepipe of any soot and other residues. The stovepipe and chimney should be inspected frequently during the heating season for creosote buildup. If you use an air-tight stove, check the stovepipe at least once a month. Your chimney cleaning schedule will depend on how frequently your stove is used and how it is operated.

I) Carbon Monoxide

Carbon monoxide can be a byproduct of the incomplete combustion of natural gas, wood, or any carbon-based fuel. It is a clear, odorless, and tasteless gas, and can cause death if gone undetected. Extended exposure to low levels (sometimes not detected by inexpensive carbon monoxide detectors) can cause long-term health problems. Carbon monoxide detectors with a minimum sensitivity of 30 ppm and with no time delay should be installed at locations where natural gas appliances or fireplaces are used. Massachusetts Home Inspections also recommends installing carbon monoxide detectors and smoke alarms on each floor of multi-story structures and within ten feet of entrances to all bedrooms.

PART 5

FOUNDATIONS

A) Inspecting your Foundation

While inspecting your foundation, many conditions inhibit me from inspecting the entire foundation, including, but not limited to, vegetation, soil, and storage around the exterior; parked vehicles, furnishings, storage in the garage, and floor coverings (carpets, vinyl, tile, etc.) in the structure interior. I do not move furnishings and storage in the garage or the structure interior, and floor coverings are not lifted or removed to inspect the sub floor or foundation in the interior. The foundation was observed to the greatest extent possible at the exterior sides of the structure, from inside the structure, from the garage interior (if present), from the crawl space opening and from inside the crawl space (if present). Any major defects that were visible at the time of the inspection will be noted in the "Structure/Basement" section of your home inspection report.

B) Wet Basements

Nothing is more frustrating than dealing with a wet or flooded basement. Wet basements and crawl spaces are sources of high humidity, which can produce surface condensation, mildew and fungi, musty odors, and an unhealthful environment. Such moisture can cause deterioration of the foundation mortar, floor joists, beams, supports, sub flooring, insulation, and electrical-mechanical systems.

Prolonged water around the footer and foundation wall can soften the soil and weaken its bearing capacity, increasing the possibility of wall settlement and cracking. Serious seepage under the foundation footer may erode soil away and cause the wall to drop or crack. Excessive moisture can eventually penetrate the sub flooring and buckle the flooring or cause warping, making doors and closets difficult to open or close. Since crawl space or basement dampness always moves toward the drier upstairs areas, higher humidity will result in costlier heating and air conditioning bills. In the case of crawl spaces, if the under flooring insulation collects moisture, or sags from excessive wetness, the heating and air conditioning costs are driven even higher. Finally, wet basements and crawl spaces reduce the value of the house--at least by the amount that would be required to repair the damage and to eliminate the cause of the problem. Some homeowners are reluctant to discuss or admit their water problem; for fear that the publicity of an actual or even a perceived problem would reduce the value of their investment.

Homeowner insurance that fully covers basement flooding damage is an important means of financial protection to homeowners. Coverage for wet basements varies from state to state and company to company. But typically, the damage from water seeping in from the outside or backing up from the sewer is not covered by standard homeowner policies. In some cases, special coverage can be purchased to cover these risks, but it is usually limited in the types of personal property it covers and amounts of coverage that may be purchased.

It is up to each homeowner to know how to prevent water damage before it starts. This can be done through proper home maintenance and installation of systems intended to remove water before it gets into the basement.

PART 5

C) Cause of Wet Basements and Crawlspaces

Most wet basements or crawl spaces are caused by surface water which is not adequately drained away from the exterior foundation wall. Sources of this water include the following:

- Roof water, if no gutters and downspouts are presently installed
- Roof water, if the guttering leaks or overflows because of clogging from leaves and bird nests
- Roof water if the downspouts (leaders) are clogged or do not have sufficient means at their outlets to drain water away from the foundation wall. Frequently, a downspout ends right at the corner of the house without an elbow and a 4-6 foot extension to carry roof water away from the foundation, leaving roof water to concentrate at that point and seep into the soil next to the foundation wall. A typical 2000 square foot roof can produce almost 1250 gallons of water during just 1 inch of rainfall. If the rainfall is steady and prolonged, the opportunity for this roof water to soak into the ground next to the foundation wall is high.
- Excessive watering of flower beds and shrubbery around the foundation wall. Once the upper soil layer or mulch bed air spaces are filled with water, the excess water either runs off or seeps into the ground next to the wall. Prolonged and excessive watering can contribute a large amount of water to basements
- Rainwater runoff from the adjacent lawn, walks, or driveway areas if the landscaping forces water to drain toward the house instead of away. If surface runoff is directed toward the foundation wall, this water will pond and eventually soak into the soil, thus becoming a potential source of basement or crawl space water. Downspout splash pads are not very effective if they drain onto a backward-draining slope toward the foundation wall.
- Subsurface or groundwater may be intercepted or dammed up by a basement or foundation wall. Houses which are built down slope on or at the base of hillsides are particularly vulnerable since there is greater opportunity for surface water to soak into the soil to become groundwater and because groundwater flows downhill by gravity. Foundation walls act like dams and can intercept and trap this subsurface water, causing pressure build-up on the outside and forcing water through joints and cracks in basement walls or seepage under the footer.
- Nearby springs may have been filled in or covered up by the developer. Unless the springs were properly drained away from the lot or subdivision, such water will eventually seep into the surrounding fill, become a pool of groundwater, and eventually force itself laterally and upwardly into basements and crawl spaces.
- Nearby creeks may overflow during storm runoff and either directly flood basement or crawl space areas, or contribute to the groundwater, which may become sufficiently high to cause seepage into the basement or crawl space area. Homeowners may not experience the effects of groundwater seepage or overflowing creeks for months or years after purchasing a house because of drought or infrequent out-of-bank flooding. However, when such conditions do occur, they may come suddenly without warning and cause serious problems after the warranty period has expired.
- Improperly installed, clogged, collapsed, or leaky drains may not allow downspout water or foundation wall water to escape. Perimeter, footer, or foundation drains are

installed around the exterior of a house below the basement floor to intercept and dispose of subsurface water to eliminate groundwater build-up and seepage under the house. If these drains are improperly installed or become clogged with silt or roots, they will not operate as intended. Sometimes an otherwise good perimeter drain gets covered up at its end(s) during the final backfilling or landscaping stages of construction and the intercepted water has no place to go but to build up behind the foundation wall and eventually to seep into the basement or crawl space.

- Underground drains leading away from downspouts may not have sufficient slope to carry water away; may empty into the adjacent lawn and get covered with topsoil; may become crushed during landscaping or become pinched at their outlets; or may lead to an area which ponds and backs up water. The end result in all these cases is leakage or overflowing at the bottom of the downspout and water penetrating the foundation area.
- Soil continuously draws water up from subsurface groundwater sources in a crawl space like a blotter by a mechanism known as capillary attraction. The finer the soil (e.g. clays), the more aggressive the capillary pumping action. As the water rises to the surface, it evaporates into the crawl space. Such ground moisture can be a significant source of dampness and humidity under a house, even without standing water. The presence of capillary water is often indicated by a whitish residue, left on the ground surface of the crawl spaces, resulting from evaporation of water containing minerals and salts. Lack of a moisture barrier, such as plastic sheet, will allow this capillary action and evaporation to contribute almost unlimited moisture sources to crawl space areas.
- Closed, inadequate, ineffective, or no crawl space venting around foundation walls will force the buildup of humidity in the space beneath a house. Given the combination of high humidity and low temperature, condensation can form on heating/AC ducts, joists, under flooring, and insulation. This environment, together with likely darkness, encourages mildew and other fungi to form.

D) Drying out a Wet Basement

If you have water running into your basement, the first thing to do is to see if it occurs immediately after a rain. If this is the case, it is probably due to surface water puddling against the outside of the basement walls. This is the most common source of basement water problems and one that you may be able to fix yourself.

First of all, you need to locate the source of entry. I suggest you look for ways exterior run-off water can enter into this area in the basement. Make sure downspout runoff isn't pooling or percolating into soil near the foundation during a storm, and that gutter and downspout seams aren't leaking. Gutters should be catching the rain and channeling it to the downspouts. Make sure there is no debris blocking the inlet of the downspout and preventing water from escaping down the spout. The downspouts should have extensions so that they discharge the water at least five feet away from the house.

Check the ground outside your foundation. Unfortunately, the earth that was used to back fill around most foundations settles over the years so it is extremely common for earth near the house to be lower than the rest of the yard. All grading should slope away from your house at

least 1 inch vertically for every 1 foot of horizontal travel. If earth is already near the top of the foundation or if your lot slopes toward the house on one side, you may need to use another approach. In this case, establish a swale or shallow ditch on that side of the house to intercept the surface water and carry it around the house and down slope toward the street. Place the drainage path as far from the house as possible. If you have enough space, the ditch can easily be made less noticeable by blending it into the lawn.

If you have pavement immediately next to the house, be sure it slopes away. If a driveway or sidewalk is either extremely flat or slopes toward the house you have several choices. You can replace the pavement and correct the grade in the process. If it is concrete, you can have it mud jacked (raised), which usually costs about half as much as replacing the concrete. You can also add an additional layer of pavement next to the house to reverse the slope. If you do the latter, you will also need to caulk joints and cracks in the drive or sidewalk so that water which pools on the surface doesn't penetrate and end up in the basement.

Window wells are another common source of basement water problems. The window well itself should be much deeper than the window sill to provide a place to catch rain that might fall into it. The top rim should be 3 to 4" above grade with the ground sloping away so that water is not channeled into the window well. If the window well is on a side of the house where wind drives rain or ice against the house, installing a plastic bubble cover over the well will help keep rain, leaves and snow out.

Fixing any grading related problems such as those mentioned here will take care of the majority of basement water problems and should always be done first, even if you are considering other measures such as repairing a leaky crack in a Poured Concrete foundation.

If that's the case, I personally recommend that you contact a Massachusetts based company called **Crack-X.** They will bond your crack surfaces together by injecting a specially formulated epoxy material that will stop water from leaking into your basement. This process closes the crack and restores the structural integrity of the wall by producing a "weld" that is equal to the original concrete in strength and performance. They will offer a ten year warranty. They can be contacted by phone at **1-877-CRACK-FX** or browse their website at **http://crackx.com**

E) <u>Severe Flooding in Basements (Waterproofing)</u>

In my humble opinion, "water proofing" systems, especially those on the exterior of a building should be used only as a last resort. Many water proofing systems involve water collection and discharge and are very costly. If you've tried all my recommendations and water is still gushing into your basement, and you can not resolve this, I recommend that you call in a professional. Otherwise, consider an interior gutter. This dam-and-channel system goes around the perimeter of the basement floor and collects water that flows down or through the walls or floor, routing it to a floor drain or sump pump. If you decide to go this route, I recommend contacting a Massachusetts based company **B-Dry** at **(781) 861-7897** or Toll Free at **1-800-696-3356.** You can browse their website at **http://www.bdryboston.com**

PART 5

F) Maintaining Your Foundation

Your foundation is your home's infrastructure. It supports the floor, wall, and roof framing. Moreover, the foundation helps keep floors level, basements dry, and, believe it or not, windows and doors operating smoothly. Your foundation is also an anchor of sorts. Maintaining your foundation is necessary to avoid structural issues that can ruin your home very slowly.
The first and foremost requirement to maintaining your foundation is to correct any underlying moisture problems that your basement may be receiving from the exterior
(Read Part 5D "**Drying out a Wet Basement**"). Once you have diverted outside water away from your foundation, the majority of your foundation maintenance is complete.

Poured Concrete

Poured concrete is tough stuff, but even concrete will crack, chip and crumble. Eventually, nature has her way. New England temperature extremes make their presence known through damage to concrete structures. I recommend that you inspect your concrete and masonry walls and slabs for damage on a regular basis. Early spring is an excellent time to assess any damage that may have happened from our winter freeze/thaw cycles.

Cracks, chips and broken or flaking areas in concrete are not only unsightly; they can lead to further deterioration of the surface and leaks if not properly maintained. The result is a costly replacement project as opposed to a simple repair once you notice damages.

Fieldstone

This type of stone foundation needs annual monitoring. A brief visual inspection of your fieldstone foundation may quickly disclose bulging, bowing, shifting or settlement of a stone foundation. If you find any one these conditions, you should call in the services of an experienced Mason to make corrections immediately. However, if the stones are exposed, and appear generally to be where the original builder placed them, you can probably handle the repairs and maintenance yourself. Determined do-it-yourselfers can perform much of the routine restoration and maintenance that will make their home's foundation last for future generations.

Most stone foundations have, or had at some time, a mortar coating on their interior. The purpose of this coating was to help hold the stones in place. This thin mortar coating will inevitably flake off from moisture migration, revealing the surface of the stones. As this coating continues to erode, the soft, sandy mortar in between the stones begins to fall out. When this occurs, re-pointing is needed as soon as possible to refill the voids where the old mortar fell out. It's important that you scrape away the outside surface of any crumbling mortar in between the stones in order to establish a small cavity which can hold the new mortar that is being applied.

To avoid perpetual repointing, you will need to finish with a complete top coating. This top coat does not have to look like a stone artisan's creation: It merely has to serve the purpose of keeping the old mortar in place. Of all the components of a building that need either restoration or maintenance, the area buried deep in the ground is often the most neglected. By taking these steps to keep the mortar in between those stones upgraded, your foundation will last forever.

PART 5

Slab Foundations

Slab foundations are the most modern, but they can vary considerably from older ones that have no moisture barrier beneath them and any reinforcing steel within them to newer ones that have moisture barriers beneath them and adjustable reinforcing steel within them. This type is called a post-tension slab, but is often impossible to distinguish one slab type from another in which even the size and spacing of the bolts can vary, although most are concealed.

My inspection of slabs conforms to industry standards. I examine the visible portion of the stem walls on the exterior of the structure for any evidence of significant cracks or structural deformation. However, I do not move furniture or lift carpeting and padding to look for cracks, and we do not use any specialized tools or measuring devices to establish relative elevations or determine any degree of differential settling. Significantly, many slabs are built to move out of level, but the average person would not realize this until there is a difference of more than one inch in twenty feet, which most authorities describe as being tolerable.

Interestingly, many slabs are found to contain cracks when the carpet and padding are removed, but there is no absolute standard for evaluating them. However, those that are less than ¼ " and which exhibit no significant vertical or horizontal displacement are not regarded as being structurally threatening. They typically result from common shrinkage, but can also be caused by a deficient mixture of concrete, deterioration through time, adverse soil conditions and poor drainage, and if they are not sealed they can allow moisture to enter your home, and particularly if your home is surcharged by a hill or a slope, or if downspouts discharge adjacent to the slab. However, in the absence of any major defects, I may not recommend that you consult with a structural engineer or a foundation contractor, but this should deter you from seeking the opinion of any such expert. Also, the condition of utility lines (drainage, water, gas, electric, cable) that might run in, under, or through walls within slab-on-grade foundations cannot be determined due to construction.

Bricks and Blocks

Bricks, at one time, were used extensively to construct foundations. Today, however, if a foundation doesn't consist of concrete, it is probably constructed of concrete block. In either case, brick and block have one thing in common. They are both joined together using mortar, a combination of sand and cement.

Unfortunately, over time, the mortar tends to deteriorate. Cracked and deteriorating mortar joints are not only unsightly, they also diminish the integrity of the surface and can allow water to get behind the brick or block causing major damage. This can be avoided by tuckpointing the brick or block foundation, which means the removal by surface scraping and replacement of cracked, crumbling or missing mortar. Monitor your bricks and blocks periodically and upgrade when deterioration is obvious.

If the cracked or deteriorating mortar is extensive (an entire foundation wall), tuckpointing is a project that is best left to professionals.

PART 5

G) Your Crawl Space

Crawlspace venting is offered, and even required in some areas, as a method of preserving the floor system over crawl spaces. Generally, in Massachusetts, vents in crawl spaces cause more problems than you think. The real effect is that higher moisture content in a vented crawl space can create a greater heating or cooling load in homes, thus creating inefficiencies. In addition, vented crawl spaces are susceptible to high humidity in the summer months, which can lead to moisture problems and mold growth. So in homes with crawl spaces here in New England, it's a good idea to modify practices so that the crawl space is unvented and completely conditioned. This will create a much more stable environment, similar to that of a typical basement. I'll explain how to properly condition a moist crawl space, but first let me to explain why vents are not a good idea here in our ever changing weather.

In freezing winters in Massachusetts, open vents in crawl spaces tend to fill the attached basement and upper living areas with cold air. Cold air flowing through any vents is ineffective at evaporating foundation moisture. Of course, very active venting could freeze the soil and this would suppress the enclosed water vapor and biological activity, but this freezing air would be hard on the plumbing pipes which could eventually freeze and burst. This cold air blowing into a crawl area can also make barefoot walking on the floor above very difficult.

In our humid New England Summers, the hot ambient air is loaded with moisture. When this air is drawn into a cool space, the entrained water vapor must condense. And it will wet all the available surfaces…the foundation, the soil or masonry floor below, and the wooden suspended floor above. For example, if 80 degree air is allowed to vent into a 60 degree crawl space, the air will saturate and indoor dew will result. This grows fungi wildly which is terrible for the health of your house and its occupants. Soaking the wooden building components adjacent to the foundation invites rot and wood boring insects as well. After some time, the space becomes a zoo leading to real structural and indoor air quality problems.

It is now understood that a major contributor to crawl-space moisture is evaporation from uncovered earth under the house. Stopping that evaporation is one key to a dry crawl space. For these reasons, I highly recommend that you have your crawl space upgraded to a conditioned space.

H) How to Condition your Crawlspace

You want to start this conditioning process by removing the moisture from the crawl area. Start by installing a high density cross laminated polyethylene plastic barrier over 100 percent of the moist dirt floor and simply lap the material up the sides of the foundation walls. All seams should overlap 1 to 2 feet and taped tightly with contractors tape. This plastic barrier will give you a cleaner and dryer area immediately. Now apply strips of pressure treated lumber at the top edge of the plastic. Use regular masonry nails to attach the strips to the foundation walls. Trim any excess plastic that projects beyond the wood strips. Apply a bead of standard caulk at the top of the wood strips to complete the job.

Now you want to place objects (Stones, Bricks, Sand, etc.) throughout the top and outside edges of this barrier to weight it down. You now have a moisture resistant conditioned area that will

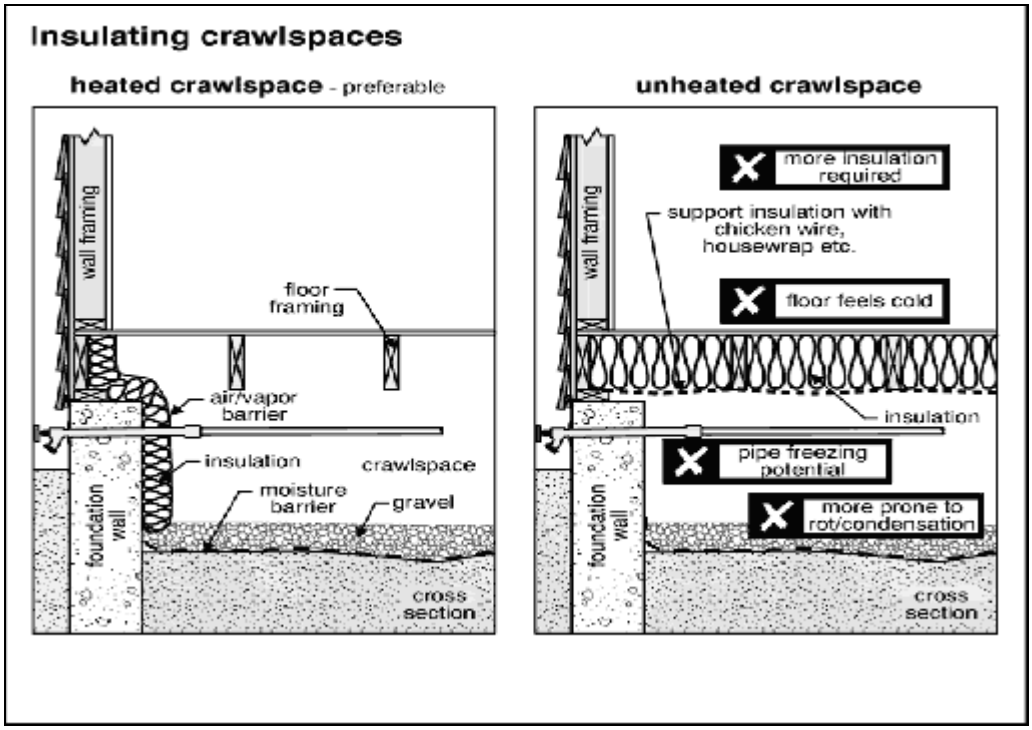
block the water vapor that is fueling the offensive aromatic microscopic mold growth in your home. Your next step is to permanently close up any wall vents and fully insulate the interior surrounding walls. Covering crawl-space walls with insulation turns your crawl space into a snug, sealed air chamber that brings further insulting value to the floor.

Essentially, you need to close up the crawl space completely by sealing any foundation vents with an insulation material that can be cut to fit tightly into those spaces. This procedure will save energy, make your house less drafty and will feel much more comfortable all year round. You have two choices of insulation use. You can glue sheets (1 or 2" thick) of rigid board foam insulation, onto the interior sides of the foundation walls all the way around the perimeter. However plastic foam boards are combustible and must be covered by a fire retardant material once they are installed.

If you're going this route, protect the insulation by covering it with stucco or another suitable protective coating. And leave a 6-inch gap between the insulation and any wood foundation element to provide a termite inspection area.

The second insulation option would be to utilize blanket insulation. Cut lengths of insulation to extend from the mudsill down the entire wall and rolled 2 feet out on top of the protected dirt floor. Make sure a vapor barrier is installed on the blanket facing inside the crawl (towards you).

Secure the blankets with 2x2 cleats: Hold the cleat over the end of the insulation and drive nails through the 2x2 and into the edge of the mudsill. Place a length of 2x4 or a few bricks on top of the insulation batts along the bottom of the wall to hold them in place. Also, cut square pieces of insulation to fit between the joist cavities and tightly press them against the rim joist. In both cases, be sure to insulate every water supply and drain pipe and heating ducts in this conditioned crawl space.



PART 6

PLUMBING

A) Plumbing Systems

I evaluate all plumbing systems and their components in accordance with State or industry standards, which include testing for pressure and functional flow. Plumbing systems have common components but they are not uniform. In addition to fixtures, components typically consist of gas pipes, potable water pipes, drain and vent pipes, shut-off valves, pressure regulators, and pressure relief valves that I do not test or dismantle.

B) Gas Piping

I recommend a safety check of all gas-using appliances by public utility before close of escrow. Gas companies typically, but not always, conduct this service free of charge. A visual inspection of the gas service systems and components did not reveal any major defects or leaks at the time of the inspection unless I noted it in the Plumbing section of your home inspection report.

C) Supply piping

The best and most dependable water supply pipes are copper, because they are not subject to the build-up of minerals that bond to the inside of galvanized pipes and gradually reduce their inner diameter and restrict the volume of water. A water softener will remove most of these minerals, but not once they are bonded within the pipes, for which there would be no remedy other than to re-pipe. The water pressure within the pipes is commonly confused with water volume, but whereas high water volume is good, high water pressure is not. In fact, whenever the street pressure exceeds eighty pounds per square inch, a regulator is recommended, which typically comes factory preset between forty-five and sixty five pounds per inch. However, regardless of the pressure, leaks will occur in any system and particularly in one with older galvanized pipes and commonly when the regulator fails and high pressure begins to stress the washers and diaphragms within the various components.

D) Waste Pipes

I attempt to evaluate drain pipes by flushing every drain that has an active fixture while observing its draw and watching for blockages or slow drains, but this is not a conclusive test and only a video-scan of the main line would confirm its actual condition. However, you can be sure that blockages will occur, usually relative in severity to the age of the system, and will range from minor clogs in the branch lines, or at the traps beneath sinks, tubs and showers to major blockages in the main line. The minor clogs are easily cleared, either by chemical means or by removing and cleaning out the traps. However, if tree roots grow into the main drain that connects the house to the public sewer, repairs could become expensive and might include replacing the entire main line.

For these reasons, I recommend that you ask the sellers if they have ever experienced any drainage problems, or you may wish to have the main waste line video-scanned before the close of escrow. Failing this, you should obtain an insurance policy that covers blockages and damage

to the main line. However, most policies only cover plumbing repairs within the house or the cost of rooter service, which are usually relatively inexpensive. No attempt was made to locate drainage cleanout caps.

E) Corrosion

Corrosion build-up is often present on pipes and valves in sink cabinets, at toilets, and at the water heater. Although corrosion is common, it can indicate leaks, static electric charges on metal pipes, dissimilar material connections (typically between two different metals), and/or chemical storage nearby, particularly in sink cabinets; other causes also are possible. Such corrosion build-up in all visible areas might not be noted in your report because it is so common. However, a significant build-up of corrosion could be concealing an active leak, although the leak in such cases usually is minor. Remember, though, that neglecting a minor leak can result in a major leak. At that point, you could have major water damage and significant mold or mildew. (See Part **8C -**"**Hazardous Substances"** regarding "**Mold**" issues)

What might have been considered light corrosion on the day of the inspection could have been the start of a problem and a more serious build-up of corrosion could be present by the time escrow closes. Any pipes that have corrosion should be cleaned and inspected. Check the pipes and valves in the sink cabinets before storing items in those cabinets. Regular homeowner monitoring and maintenance is easy to do.

F) Shower Pans

Shower Pans are visually checked for leakage, but leaks often do not show except when the shower is in actual use. Determining whether shower pans, tub/shower surrounds are water tight is beyond the scope of my inspection. It is very important to maintain all grouting and caulking in all bath areas.

G) Private Water Wells

If your perspective house is equipped with a private well, Massachusetts Home Inspections recommends that you have the bacteriological quality of the water tested before purchasing your home. I recommend that this test be performed before the close of escrow and annually thereafter. The EPA recommends that you test your well water annually for nitrates and coliform bacteria. I **do** offer Water Quality testing through a State-certified laboratory and your results will be ready in 2 days.

Each water test varies as to what is being tested. The following tests can be performed…Coliform & E.Coli, Arsenic, Chloride, Copper, Fluoride, Gross Alpha, Hardness, Iron, Lead, Manganese, Ph, Nitrate, Sodium and Radon in water.

The results of your water tests might show contaminants that are offensive, but not health risks. The lab can advise you about the differences between that type of contaminant and dangerous contaminants, and their possible sources. In addition to regular tests, well water should be tested immediately if there is any change in its clarity, color, odor or taste, or if there has been a change

in the surrounding land use. Through regular assessment and testing of your water supply, the microbial and chemical safety of your well water can be verified.

H) Water Heater

Most people don't give much thought to their water heater - they just turn on the faucet and expect hot water to come out. Well, it's not that easy. I recommend keeping your water heater in peak operating condition by performing some very simple maintenance.

1.) Once every six months, **drain one gallon of water** from the tank. If you have hard water, do this every month. This reduces the amount of sediment collecting in the bottom of the tank, which can make the burner or heating coils work harder.

2.) Once every two years, have your water heater **inspected by a service technician**. This will help keep it in peak operating condition, and will prevent dangerous carbon monoxide problems.

And don't forget: Before doing any maintenance on your water heater shut off power at the service panel and read your owner's manual. Some repair attempts you make could void the warranty.

I) Septic system

The purpose of an on-site wastewater treatment system, commonly known as a **Septic system**, is to treat sewage from your household. A septic system has two parts: the sewage tank and the soil treatment system. The most common sewage tank is a septic tank that receives raw sewage from the household. Three layers form in the tank: solids settle to the bottom and a layer of scum or grease floats on the surface of a liquid layer. As raw sewage is added to the tank; an equal amount of liquid flows out into the soil treatment system known as the leaching field.

Maintaining your septic tank

- **Discharge all sewage waste from the house into the septic tank.** Don't run wastewater from laundry or saunas directly into the drain field as the detergent or soap scum will quickly clog soil pores and cause failure.
- **Do not add "starters" to your septic system.** Enough bacteria are available in the wastes flushed into the septic tank. Even after the tank has been pumped, enough bacteria will be provided when you use the system again.
- **Do not use additives in your system.** They are of no benefit and may harm the system. Additives that cause the accumulated sludge to increase in volume or float will result in sludge being flushed into the drain field, plugging soil pores. Also, some additives, particularly degreasers, may be carcinogens that will flow into ground water with treated wastewater.
- **Have the septic system checked** every one to two years and pumped every two to three years by a professional septic system contractor to remove solids and scum. Although tanks that are away from lakes or rivers may not need it every year, annual pumping is excellent insurance near shorelines.

PART 6

- **Remove the manhole cover when having the tank pumped** to make sure that all solids have been removed. The sludge in the tank should be mixed during pumping. A tank cannot be adequately cleaned through a 4-inch inspection pipe. Pumping through the inspection port may clog the outlet baffle with scum and grease.
- **Do not use** the system as a trash can. Garbage disposal use is a leading factor in clogged systems. Don't put grease, oil, disposable diapers, colored toilet paper, paper towels, tissues, paint, pesticides, coffee grounds or other items down any drains in your home.
- Plant only grass over and near your septic system. Roots from trees or shrubs may clog and damage the absorption field.
- Keep roof drains, sump pump drains, and other rain or surface water drainage systems **away from the absorption field**. Flooding can keep the soil from naturally cleansing the waste water.
- **Be alert**. Unpleasant odors, soggy soil, liquid waste flow, or excessive grass growth over the soil absorption area can be signs that the system is in need of service.

When properly maintained, septic tanks are safe and reliable. It will cost $75 to $150 each time you have a septic tank pumped, but replacing the entire system and drain field may cost from $2,000 to $7,000. Threats to human health and water quality increase if your septic system is not properly maintained.

These conditions indicate that...

YOUR SEPTIC SYSTEM MAY BE FAILING

- **Sewage backup in your drains or toilets.** This may be a black liquid with a bad odor.
- **Slow toilet flushing.** Even if you use plungers or drain cleaners, drains may run slower than usual.
- **Wet areas or water seeping near drain field.** It may or may not have an odor.
- **Excessive growth of aquatic weeds or algae in the lake near your home.** Incomplete treatment of nutrient-rich water seeping from your system promotes this growth.
- **Unpleasant odors around your house.** This may result from improper venting or a failing system.
- **Bacteria or nitrates are found in your well water.** This indicates a serious water contamination problem that may come from your own or a neighbor's failing system.
- **Biodegradable dye flushed through the system shows up in the lake or river.**

Immediate Actions

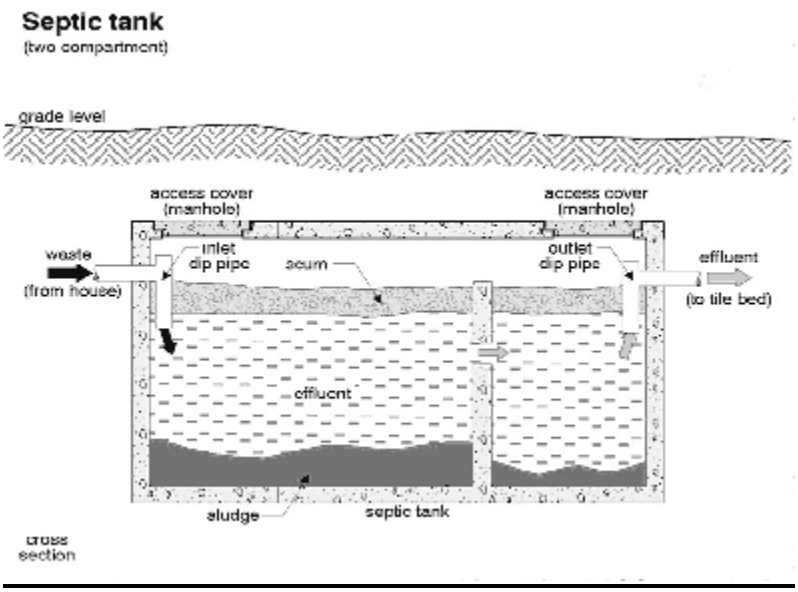
- **Call the local health or zoning and planning department.** They will help you get the expert advice you need to solve your problem.
- **Have the septic tank pumped, making sure that sludge as well as liquid is removed.** This will often help solve the problem temporarily, particularly if you also

cut back significantly on water use. If the drain field or household piping is clogged or if high water levels are a problem, this won't help.

- **Fence off the area to minimize contact with wastewater** (for humans, pets, and wildlife).
- **Don't use additives.** Additives are no benefit and may harm the system.

Follow these Guidelines to Prevent System failure.

- **Wash only full loads in the dishwasher.** Typical dishwashers use about 13 gallons for each wash. Newer models use 8-9 gallons.
- **Use low-phosphate dishwasher detergent.** Detergents may contain up to 11% phosphorus by weight; but some brands may exceed this level, so check the labels.
- **Wash only full loads of clothes and use front-loading washers and suds-savers to save water.** To avoid overloading your system, spread washing over the week instead of washing several loads on one day. A single load takes about 40 gallons.
- **Use liquid laundry detergent** because it's less likely to have fillers or carriers that may damage the septic system. Try to use the minimum amount because detergents can cause problems with the system.
- **Minimize use of household chemicals and cleaners.** Normal amounts of household detergents, bleaches, drain cleaners, toilet bowl deodorizers, and other cleaners won't harm bacterial action in the septic tank.



PART 6

J) Sink Cabinets and Chemical Storage

Think about what's typically located in your sink cabinets: the underside of stainless steel sinks, garbage disposal metal casing, copper water supply pipes, and plastic or metal drainage pipes.

Plastic and metal are affected by corrosive chemicals, and continued corrosion and rusting can eventually result in leaks. Most people, though, store everyday chemicals in the sink cabinets.

This is the absolute wrong place to store such items because most cleaning chemicals by their very nature are corrosive. So, do not store chemicals in sink cabinets. Additionally, children won't gain access to harmful and dangerous chemicals.

And no one ever takes all those chemicals out of the sink cabinets to inspect the cabinet floor and the water and drainage pipes—unless they're moving, or a significant leak is noticed, or a child is injured after gaining access to the chemicals.

Water supply and drainage pipes should be monitored regularly, and here's how to do it virtually on a daily basis with no effort at all on your part: Store dry materials (towels, bathroom tissue, boxes, etc.) in sink cabinets. This type of storage allows one to check for leaks in sink cabinets each time something dry is removed. If normally dry materials are wet, check for leaks or deteriorated caulking/grouting around the sink and countertop, and have a qualified plumber repair or replace any plumbing components or have the deteriorated caulking/grouting repaired.

So where should you store such chemicals? A high cabinet in the garage or at an exterior location is great, but if you must keep them inside, an upper hallway closet, the cabinet above the microwave oven, or the cabinet above the refrigerator make great interior locations.

K) Caulking and grouting

Caulking and grouting is typically found in the kitchen, bathrooms, and laundry area at connections between the toilet and floor; the bathtub floor and wall; the shower floor and wall; and sink and countertop. Deteriorated or cracked caulking or grouting can allow moisture to penetrate into structural framing, causing water damage or promoting the growth of mold. It is impossible to tell how long deteriorated grouting or caulking has existed, and moisture might have penetrated subject areas and caused damage which is not visible and can only be determined by remodeling/renovation or destructive testing.

Before deteriorated grouting or caulking is repaired, the substructure should be examined for evidence of structural damage or deterioration. While recaulking and regrouting normally is not a cause for concern, and homeowner maintenance typically is to be applauded, in today's world of mold disclosure and mold claims, the reason behind recaulking/regrouting is that moisture penetration into the structural framing might have occurred, possibly causing structural damage or promoting mold growth. Remodeling or removal of shower and/or bathtub sections could indicate moisture damage or structural damage that was concealed at the time of the inspection. Concealed defects are not within the scope of the home inspection.

PART 7

ELECTRICAL

A) Testing Electrical Outlets

While testing the outlets, I **do not** unplug any items to test a specific outlet. I have a choice of unplugging every item or unplugging no items. Making decisions on a case-by-case, site-specific basis on what to unplug would not be fair to all my Clients. Unplugging every item presents problems when there is programmable and sensitive equipment that could be damaged by power surges when plugging the equipment back in or turning it on, lost data from programs running on computers, and safety concerns. In many cases, looking at the equipment's switches and lights tells me whether the outlet is functioning, although looking at equipment will not tell me if the outlets are wired or grounded properly. If you have any concerns about any specific outlet, particularly if it is going to be used for sensitive equipment, have the outlet tested by a qualified licensed electrician.

B) Service Entry Panel

I **always** remove the outer and inner covers of electric panels that are safely accessible to inspect the wiring configuration inside. I **do not** remove any circuit breakers to look for bad contact points, rust, or corrosion since doing so would require disconnecting electric service to the structure. My methods are consistent with generally accepted home inspection standards. If you have any questions concerning electricity issues in your perspective home, please feel free to call me.

C) GFCI (Ground Fault Circuit Interrupter) Safety Outlets

These are receptacles that typically have the black and red test buttons on them. GFCI outlets should be present near all sources of water and near metal-encased appliances that do not have electric motors (such as a cook top, oven, coffee maker, toaster, etc.). GFCI **protected** outlets are outlets which are "downstream" of GFCI outlets, meaning that they are on the same circuit as a GFCI outlet. If there is no electricity to a protected outlet, the GFCI outlet at a separate location might have tripped and disconnected electricity to the circuit. Typical areas where you might find GFCI or GFCI-protected outlets include the garage, laundry, kitchen, bathrooms, and exterior locations.

You should test the GFCI outlets as soon as you move in, noting at the same time any protected outlets that may be present and which GFCI outlets control those protected outlets; typically the protected outlets should be labeled as such. Although they are proven life-saving devices, they are known to fail on a regular basis and should be tested monthly to ensure that they are functioning properly. To test the GFCI outlet, first plug a nightlight or lamp into the outlet. Turn the light on, and then press the "TEST" button on the GFCI outlet. The GFCI outlet's "RESET" button should pop out, and the light should go out. If the GFCI outlet is functioning properly, meaning that the light does go out, press the "RESET" button to restore power to the outlet. If the "RESET" button pops out but the light does not go out, either the GFCI outlet is not working properly or it is incorrectly wired. Call a qualified electrician to evaluate the problem. Usually the kitchen GFCI outlet will control any other outlets in the kitchen (sometimes more than one

GFCI outlet is present in the kitchen). Sometimes all the bathroom outlets are placed on the same circuit, with only one GFCI outlet protecting the outlets in all the bathrooms. Occasionally a GFCI outlet in the garage will protect outlets in various bathrooms. Such garage installations can be inconvenient, particularly in multi-story buildings.

If GFCI outlets trip regularly, consult a qualified electrician immediately to determine why the tripping is occurring. GFCI outlets trip quite often when hair dryers are used on the circuit due to the electricity surge typically needed to start the dryer. If you notice this happening, try starting the dryer on the lowest setting and then moving up to the higher setting after a few seconds. If your circuit continues to trip, consult a qualified electrician for further evaluation.

D) What is a Ground Fault Circuit Interrupter?

GFCIs are found in outlets and service panels. They monitor the flow of current to and from appliances. If there's an imbalance in the flow, because of a frayed wire or faulty device, current may attempt to travel through you, and the GFCI will quickly cut power to prevent serious injury. Unless you have an outlet with a Ground Fault Circuit Interrupter (GFCI), you may be seriously shocked or burned because *you* may be the shortest route to the ground. Although they prevent electrocution, there is still a risk of electric shock.

E) Potential Electrical Problems

- Anytime you are shocked in your home: A properly wired and grounded electrical system will protect you from most potential shocks.
- Overloaded outlets or outlet multipliers: Too many appliances plugged into a single outlet could indicate your house may not have the required number of outlets. The National Electrical Code requires that outlets be spaced every 12 feet of running wall space, or one on each wall of the average 10-foot-by-12-foot room. Kitchens typically require outlets spaced every four feet along the countertop.
- Flickering or dimming lights: This could indicate loose connections, overloaded circuits, improper wiring, or arcing and sparking inside the walls.
- Hot, discolored receptacles, switch plates, cords or plugs: If you can't keep your hand on these for more than five seconds, you may have an overload or product malfunction.
- TV screen or computer monitor shrinks or wavers when a large appliance is turned on: This could mean that you have too many appliances plugged into one circuit or that your house needs additional electrical capacity.
- Unusual smells: Burning metal or plastic smells may indicate a loose connection, malfunctioning switch, light fixture, broken connection, and overheating components, arcing or sparking inside the walls, damaged wire, or other potential hazards.

F) Indoor Safety Tips

- Never remove the third prong from a grounded three-prong plug to make it fit into a two-prong outlet. This could cause electrical shock. When you are using a plug with three prongs, the rounded third prong connects inside the outlet with a "ground wire" which usually connects to a water pipe or a ground rod at the service panel. As a result, in a

short circuit, electricity should flow to the ground instead of through you. Removing this prong is very dangerous.

- If you must utilize a two prong outlet (ungrounded) with a three prong plug, I recommend that you have an electrician replace the outlet with a GFCI receptacle.

- Use only appliances and equipment approved by Underwriters Laboratories (look for the UL listing on the label), or other recognized testing laboratories.
- Don't overload outlets with cords. If your TV picture shrinks or flickers when major appliances go on, or if fuses or circuit breakers blow frequently, you should have your circuits and wiring checked.
- Extension cords should only be used only as a temporary fix. Do not use them as a substitute for household wiring. And don't run these cords under carpets, rugs or furniture; when cords are placed in an area where they can be stepped on frequently, the wires may separate and could lead to a short or even a fire.
- Never unplug or carry anything by its cord.
- Make it a habit to unplug small appliances when they're not in use, and push them to the back of your counters. And make sure you use all three prongs of your appliance plugs, and replace worn or frayed cords immediately. Never force a plug into an outlet if it doesn't fit, and never nail or tack cords to walls or floors.
- Teach your kids not to poke things into electrical outlets, toasters, or any other appliances, whether they're on or off. Use plug covers or inserts in all your outlets if children are present.
- Keep electrical cords away from kids' reach. Teach them that electricity and water never mix. Keep all radios, hair dryers and other appliances secured or out of bathrooms and water sources. Keep appliances like hair dryers away from water-filled tubs and sinks.
- Keep appliances like hair dryers away from water-filled tubs and sinks.

G) Outdoor Safety Tips

- Teach your children to recognize "Danger" signs and not to climb in trees if power lines pass through or near them. They should also know that pad-mounted transformers (those metal cabinets on concrete pads) are not safe places to play.
- If you have overhead electrical service, watch out for the drop line from the utility pole to your house. Don't hit it with implements or let other wires touch it. Be particularly careful when you are unloading ladders and long materials from your car, truck or garage.
- Overhead power lines might look insulated. They aren't. The dark color may be weather protection or oxidation... Not insulation. And even an insulated line may have flaws in the insulation, and contact could mean serious injury. Keep away! If you must work near power lines, contact the utility company involved before you start work. Ask that safety measures be taken, or that the lines de-energized.
- Before doing any digging 12 inches or deeper, remember to Call before you dig. The **Underground Utilities Location Center**, 48-hours before you start your project to have utilities located free of charge. The toll-free number is **1-888-344-7233.** Their website is located at **http://www.digsafe.com**.

- Outdoor electrical outlets should have weatherproof covers. When using portable saws, trimmers, or drills, keep the cord behind you where it can't be cut. Always use outlets with GFCIs to protect against serious shock.

H) Circuit Breakers

Located inside of your home is a circuit breaker panel that contains circuit breakers for each of the circuits in your home. Some homes have more than one circuit breaker box, there may be a main panel plus one or more sub panels in other locations.

A circuit breaker provides protection for each of your electrical circuits by stopping the flow of current if an overload or fault occurs. When an electrical fault occurs or the load on your circuit becomes too great, the breaker on that circuit trips and ceases the flow of current to that circuit. A tripped circuit breaker is still sometimes referred to as a "blown fuse" in reference to the older technology that circuit breakers replaced.

How to Reset a Circuit Breaker…

Before electricity can be restored, the circuit breaker must be reset. However, even before you do that, you must take steps to ensure that it is safe to do so. Turn off or unplug all of the devices that are plugged into the circuit. Make certain no dangerous condition exists before restoring power.

A circuit breaker which has been tripped will either be in the middle or "OFF" position. Locate the tripped circuit breaker and reset it by pushing it all the way to the "OFF" position and then back to the "ON" position. Electricity should now be restored to the circuit. If the circuit breaker trips again before you have turned anything on or plugged anything in, the breaker itself may need to be replaced or a serious wiring fault may exist. Immediately consult a qualified licensed electrician.

If the circuit breaker trips after plugging in or turning on a device, that device may have a short or may be placing too much of a load on the circuit. If no circuit breakers were tripped and you still do not have power at an outlet, there may be a wiring fault, the outlet may be defective or it may be on a GFCI controlled branch circuit. Refer to the earlier section on GFCIs for checking a GFCI outlet.

I) Fuses

Located inside of your home is a fuse box that contains a fuse for each of your home's circuits. A fuse provides protection for each of your electrical circuits by stopping the flow of current if an overload or fault occurs. When an electrical short occurs or the load on your circuit becomes too great, the fuse on that circuit burns out and breaks the circuit; this is what is referred to as a "blown fuse."

PART 7

How to change a fuse…

Before electricity can be restored, the fuse must be replaced with a new fuse. However, even before you replace the fuse, you must take steps to ensure that it is safe to do so. Turn off or unplug all of the devices that are plugged into the circuit. Make certain that no dangerous condition exists before restoring power.

Replace the fuse with a fuse that is of the proper rating for the circuit. For instance, if the circuit is rated for 15 amps, use a 15 amp fuse. Never use anything other than a fuse of the proper rating. I recommend that you install "Fuse Stats" or "Type S" inserts at all fuse sockets which will only allow the correct size fuse to be installed and prevents over fusing of any circuits.

When removing or inserting a new fuse, NEVER touch the metal parts of the fuse. If your fuse box is equipped with a master switch to cut power to the fuse box, cut the main power prior to replacing the fuse.

Electricity should now be restored to the circuit. If the fuse blows again before you have turned anything on or plugged anything in, a serious wiring fault may exist. Consult a qualified licensed electrician immediately. If the fuse blows after plugging in or turning on a device, then that particular device may have a short or may be placing too much of a load on that particular circuit. If no fuses were blown and you still do not have power at an outlet, make certain that the switch, if any, that controls the outlet is turned on. If you can find no problem, the outlet, switch, wiring or some other component may be at fault. Also, the outlet may be on a GFCI branch circuit. Refer to the section on GFCIs for checking a GFCI outlet.

J) Existing Knob & Tube Wiring

Knob and tube wiring gets its name from the way it's installed. There are ceramic tubes for wires that run through any lumber framing and knobs when the wires run along or next to lumber framing. The two wires (there is no ground wire) are separated about four inches apart, one is the black "hot", and the other is the white "neutral" (although some knob & tube wires are not different colors). The connections for knob & tube wiring are open and visible. The wires are spliced and soldered together with older style fibrous electrical tape around the splices. Knob & tube wiring was installed in houses up until about 1945, although in rural areas until about 1950.

As I stated, knob and tube wiring does not have a ground wire. A ground is necessary if you are plugging in appliances that have a third prong in the plug. However, if the knob and tube wiring is limited to bedrooms, living room, dining room, etc, this is not necessarily a hazard. Plugging in a two prong lamp, TV, or clock is just as safe as a three prong grounded outlet.

Knob and tube wiring is not necessarily dangerous. If it was installed properly, with the insulation in good condition and not abused with over splicing and connections, it can provide many more years of reliable service. It is wiring that has been abused that is the potential hazard. On its own, knob & tube wiring is not inherently a problem. If the knob & tube wiring is on top of the attic floor, it could be easily nicked or the insulation could be worn off, causing a safety

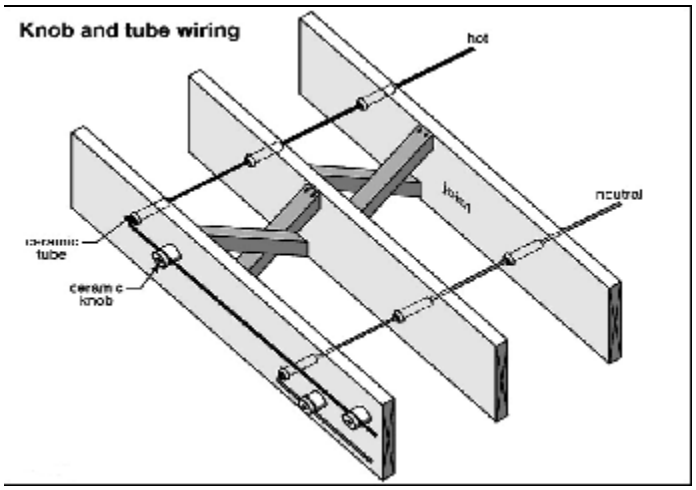
hazard. If the knob & tube wiring is in a traveled area, even for "just storage", I highly recommend it be protected or replaced.

Although knob & tube is a workable system, and safe when installed and used properly, there are some concerns with this system…

- There's no ground wire (for more modern lifestyle requirements and safety)
- A fear exists that the black and white wires can make contact (a potential fire and safety hazard),
- The rubber and cloth insulation around the knob & tube wiring breaks down over time and becomes brittle (a potential fire and safety hazard)
- It would be too costly to maintain or even install this type of wiring today
- More importantly perhaps, some insurance companies are now refusing to provide home owners insurance on houses with existing knob & tube wiring.
- It can not be run in or under insulation. This often happens when outside walls or attics are insulated. Old wiring was installed in open spaces so that it would stay cool. The insulation around the wires was made of rubber that burns at a relatively low temperature. If surrounded by house insulation, the wires will not cool and could heat up enough to burn. It is important that if an old house is to be insulated that any knob and tube wiring be re-wired first.

Many things that we plug in have a three prong plug. The large round prong is the ground. Those little three to two prong adaptors bypass the ground safety circuit. This is a particularly bad idea if you are plugging in a computer because computers dissipate harmful static electricity through the ground wire. Without a true ground, you're putting yourself and your equipment at risk. Using knob and tube wiring for wall outlets is where hazards are more likely to occur. Everyday items in the bathroom can quickly overload a 15 amp circuit. A 1500 watt hair dryer and a 300 watt curling iron plus a light bulb exceed 15 amps.

A cost effective strategy in old homes is to abandon any of the electric outlets wired with knob and tube and have new grounded outlets installed with modern wiring and keep the current knob and tube overhead lighting wiring in service. However, I still recommend eventually updating.



PART 8

Hazardous Substances

Many materials used in older home construction contained potentially hazardous substances such as asbestos, lead, Urea-formaldehyde foam insulation and other potentially hazardous materials. These and environmental issues such as mold, radon gas, and water pollutants, can not typically be fully identified and/or categorized by a visual inspection. Therefore, they are not part of my Basic Home Inspection.

I will always attempt to point out visible substances that may be considered dangerous to your health, but unless otherwise stated in your report, the existence of hazardous materials, which may or may not be present on the property, was not observed by Massachusetts Home Inspections.

Your report will state if such materials were observed and I will identify the exact location, but I can not confirm said substances since laboratory testing and, in many cases, experts or appropriate licensing in the State of Massachusetts is necessary to detect the presence of such substances. If you have any concerns about whether such materials might exist in your home, please consult with an appropriate industrial hygienist, hazardous materials specialist, or other qualified expert.

A) Asbestos - *What is it?*

"Asbestos" is the name given to a group of minerals that occur naturally as bundles of fibers which can be separated into thin threads. The fibers are heat resistant, resistant to chemical attack, have excellent tensile strength and have high electrical resistance. These properties make asbestos a useful material for electrical and thermal insulation. It was often added to building materials for this reason.

There are several types of asbestos; the most common are…

- Chrysotile or white asbestos;
- Crocidolite or blue asbestos;
- Amosite, which usually has brown fibers; and
- Anthophyllite, which usually has gray fibers.

Asbestos fiber masses tend to break easily into a dust composed of tiny particles that can float in the air and stick to clothes. The fibers may be easily inhaled or swallowed and can cause serious health problems. Asbestos containing materials are therefore divided into two categories: friable and non-friable. Friable means that a material is able to be reduced to powder by hand pressure. Asbestos containing materials that are friable, by their nature, have a much greater tendency to release fibers. They require specific control measures to prevent releasing fibers into the air. Conversely, non-friable asbestos containing materials, by their nature, do not want to give up their fibers into the air.

PART 8

Asbestos in your home

Although some of this material has been removed over the years, there are many thousands of tons of asbestos still present in our homes today. There is still extensive repair and removal work, which will continue for the foreseeable future.

The main source of asbestos in indoor air is Insulation products. Buildings that were built in the last 50 years used a variety of materials composed of asbestos mixed with other fibers like paper, fiberglass, or synthetic fibers and a binder, usually lime or gypsum mortar. Manufacturers used it for strengthening cement and plastics as well as for insulation, fireproofing, and sound absorption.

Today, the most common domestic materials (in your home) that may contain asbestos are…

- Furnace and Boiler blanket insulation
- Stove and Flue pipe insulation
- Tape at supply duct connections
- Hot water Pipe insulation
- Attic insulation (usually vermiculite)
- Artificial ashes and embers for use in gas-fired Fireplaces
- Roofing Shingles and Siding material
- Linoleum floor coverings (usually the 8"x 8" tiles)
- Plaster patching compounds
- Textured paints
- Parts of some pre-1979 appliances (e.g. toasters, clothes dryers, hair dryers)
- Asbestos was also used as a component of spray applied to textured ceilings. For many years, acoustic-ceiling texture *"cottage cheese ceilings*" was a standard feature in many homes, and until the late 1970's, asbestos was a common component of that material. Fortunately, this type of asbestos is not regarded as a significant health hazard unless it is disturbed.

Hazards of Asbestos

Asbestos is a respiratory hazard and respiratory/gastrointestinal carcinogen. Asbestos tends to break down into a dust of microscopic size fibers. Exposure to asbestos occurs when respirable fibers are released into the air and then inhaled. Because of their size and shape, these tiny fibers remain suspended in the air for long periods of time and can easily penetrate body tissues after being inhaled or ingested. Remember, asbestos fibers are much too small to be seen without a powerful microscope. In fact, an average human hair is approximately 1200 times thicker than an asbestos fiber.

Because of their durability, these fibers can remain in the body for many years and thereby become the cause of asbestos related diseases. Since exposure occurs when asbestos is inhaled, the best way to prevent exposure is to prevent asbestos fibers from becoming airborne.

PART 8

Should asbestos removed?

Even though the EPA restricted asbestos use as a building material in the 1970s and proposed a 10-year phase-out of products containing asbestos in 1986, people living in homes and using products built earlier are understandably nervous.

Generally, asbestos-containing materials do not have to be removed from any residential property. In fact, asbestos-containing material does not have to be removed from any residential structures unless it will be disturbed during renovations or demolition activities. As long as the asbestos-containing material is in good condition, in tact and will not be disturbed; it does not pose a significant health risk. It's when asbestos is exposed and friable, flaking or crumbling, and that it's likely to become airborne, is when I recommend encapsulation or professional removal by properly licensed personnel. **Removal should never be attempted by the homeowner**. This action requires special equipment and detailed training which would generally be too expensive and time-consuming for a homeowner to acquire for a one-time job. Removal is also the last choice among alternatives because it poses the most risk of fiber release if not done properly.

B) Lead - *What is it?*

Lead has been mined, smelted, and compounded for thousands of years. Lead is a neurotoxin metallic element that was historically used in paint, gasoline and plumbing materials for many years. Lead was easy to work with for a variety of purposes, which is why mining and smelting of lead has caused millions of tons to be spread into our environment. ***Lead poisoning*** occurs only when too much lead accumulates in the body. Generally, lead poisoning occurs slowly, resulting from the gradual accumulation of lead in bone and tissue after repeated exposure.

However, it is important to note that young children absorb 50% of a lead ingestion while adults absorb only 10%. Lead is very dangerous for children under the age of six because it is absorbed more readily into their blood and stored more easily in their bones and internal organs.

Lead can be absorbed by the body, primarily through the lungs and stomach. It can damage the brain and other developing organs. Lead poisoned children can suffer from permanent learning disabilities, behavioral problems, hearing problems, developmental delays, reduced hand-eye coordination and other serious health conditions.

Where can lead be found?

- **House Paints** - Most houses built prior to World War II had lead-based paint applied to the interior or exterior surfaces. It was used until 1978, when it was banned. Some of these paints still remain inside older homes and may be particularly hazardous if in poor condition (chipped or peeling) or if disturbed by sanding or abrasion (creating lead dust).
- **Drinking Water** - is a potential source of lead. This is usually from lead in solder, fixtures and piping in the home. Some water pipes in homes built before the 1930's were made of lead. In both old and new homes, lead solder was also used in copper piping. Both can be a source of lead in drinking water.

PART 8

House paints

Lead was used in paint because it lasted forever in the environment and never broke down into a harmless substance. The amount of lead in paint was reduced in 1950 and further reduced again in 1978. Houses built before 1950 are very likely to contain lead paint while houses built after 1950 will have less lead in the paint. House paint sold today has very low levels of lead.

Lead dust is released from chipping and peeling paint; home renovation projects that disturb lead paint; and lead paint ground up by friction, such as on window sashes, porch floors, etc. Because children naturally engage in hand-to-mouth activities, they are more likely to accidentally ingest lead.

Over many years, painted surfaces usually crumble into household dust. This dust clings to toys, fingers and other objects that children normally put into their mouths. This is the most common way that lead gets into your child. Children also get lead into their bodies by chewing on lead painted surfaces. Some young children even eat paint chips that are peeling or chipping. The taste is what makes them come back for more. Believe it or not, Lead paint taste sweet, so children and pets are attracted to the taste of lead paint. In accordance with Massachusetts law, any unit or single family home with an occupant who is less than six years old must be deleaded.

Testing For lead paint

To determine the presence of lead in paint, dust, water, and soil is best done by trained professionals. Massachusetts requires all lead inspectors to be state-certified.

Professional testing companies use three basic methods to measure lead in paint:

- X-ray fluorescence (XRF) uses portable detectors that X-ray a painted surface to measure the amount of lead in all the layers of paint. This type of testing is done in the home and disturbs little, if any, paint.
- Laboratory testing of paint samples involves removing samples of paint from each surface to be tested, usually from an area of about two square inches. Samples are sent to laboratories for analysis. This method leaves a bare spot on each surface tested.
- Spot checks are performed with swabs. Swabs do not tell you how much lead is present and their reliability at detecting low levels of lead has not been determined. Professional testing for lead in paint is recommended.

Drinking water

Although your drinking water is not usually a concentrated lead source like paint, it can still pose risks to your family. Those at the greatest risk, even with short-term exposure, are young children and pregnant women. Lead in drinking water can be a problem for infants whose diet consists of liquids-such as baby formula made with water. Never use water with high lead levels (more than 15 ppb) to mix infant formula. It can impair a child's development, resulting in learning disabilities or stunted growth. Exposure for adults primarily affects the peripheral

nervous system and can cause impairment of hearing, vision, and muscle coordination. Lead is also toxic to the blood, kidney, heart, and reproductive system.

Lead can enter your water from several points: Old lead pipes that connect your house to the water main (service lines), lead pipe connectors, lead-soldered joints in copper plumbing, and Chrome-plated faucets are generally made of brass, which contains 3 to 8 percent lead. In some private wells, underwater pumps with brass fittings can cause elevated lead concentrations in drinking water, especially with new pumps and soft water. Contamination can occur when water comes in contact with these fixtures.

When water stands in lead pipes or plumbing systems containing lead for several hours or more, the lead may dissolve into your drinking water. This means the first water drawn from the tap in the morning, or later in the afternoon after returning from work or school, can contain fairly high levels of lead.

Testing your water

For the public's protection, Congress enacted the Clean Water Drinking Act in 1974 and strengthened it in 1986, setting minimum water quality standards for most homeowners. Unfortunately, however, there is no guarantee that all utilities comply with the regulations.

Enforcement is difficult on national, state and local levels; not all known contaminants are on the list; and all testing isn't necessarily accurate. Having your water tested will let you know if there is lead in it. If lead levels are greater than 15 parts per billion (ppb), **action is highly recommended.** Testing is the only way to tell if there are harmful levels of lead in your drinking water. You should consider testing your water if:

- Your home has lead pipes (pipes are a dull gray color, soft enough to be scratched with a knife or key).
- Your home has older copper plumbing and / or chrome-plated fixtures.
- You see signs of corrosion from your water (frequent leaks, rust-colored water, stained sinks, dishes or laundry).
- You use water from a private well. Private water supplies can contain lead in the plumbing or the fixtures, or both.

If you are concerned about the quality of the water in your home, you may wish to have your water tested. Massachusetts Home Inspections will gladly draw a sample of your tap water and have our independent certified lab analyze your water for unhealthy levels of contaminants. I will contact you with the test results within two days.

If (after testing) you find that the levels of any contaminants are high, then you need to take action immediately. Depending on the pollutants involved, your next steps may vary. For severe lead contamination, you may need to install a water treatment device, such as a reverse osmosis system, a distillation system, or an activated carbon filter. While you may simply install a water filter, I recommend that you look for lead pipes in your home or look into whether there may be lead lines that feed into your house.

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C) Mold in Your Home

Massachusetts Home Inspections is not a mold testing laboratory; therefore, the identification of specific types of mold is beyond the scope of my home inspection and I cannot state unequivocally whether any specific type of mold is or is not present. When I do smell musty odors or see mold-like substances growing, I, of course, note it in your report for you. If you want to know what specific type of mold is present, you should seek the services of a qualified industrial hygienist or a qualified mold testing laboratory. Only they have the necessary knowledge and laboratories equipped to determine what types of mold are growing and thriving in your home.

Most of us know what mold looks like and smells like. Mold, mildew, and other toxic organisms commonly occur in areas that show evidence of, or have the potential for, moisture intrusion and/or inadequate ventilation.

Any area or item exhibiting such conditions can be a health hazard to some people, particularly children, pregnant women, the elderly, and other people whose immune systems are compromised. The key to controlling mold is controlling moisture: reduce moisture (keep the interior of your house dry and the humidity level below 45%), remove visible signs of mold, and disinfect surfaces. If a water invasion occurs, eliminate the water source and dry, repair, and/or replace any wet areas and items as quickly as possible.

Thousands of different types of mold occur naturally throughout Massachusetts, but apparently only a few of them cause health problems. Mold spores move naturally through the air and can be found in every area of the home, and there's nothing you can do about it.

You are breathing Mold as you are reading my manual. It grows on most building materials as long as the requisite moisture is present. Since many homeowners do not regularly inspect their own homes for water and drainage leaks, mold problems do continue to grow inconspicuously in our homes and buildings daily. You can easily prevent mold from growing and thriving in your home, and affecting your health, by inspecting your home (especially the attic and basement) on a regular basis (monthly at a minimum) for water and drainage leaks.

If you see mold or smell musty odors, chances are great that you have mold growing in your home, and you should first seek out and correct the problems that are providing the mold with the moisture that it needs to grow and thrive. Remove all the items stored under your sinks and inspect the water and drainage pipes, valves, and connections for leaks. Have any leaks repaired immediately by a licensed plumber. Inspect around sink basins, bathtubs, and shower stalls for deteriorated grouting or caulking. These are areas where water can penetrate into the structures' walls and framing, allowing mold to thrive in those spaces. After using your shower or bathtub, you should use your exhaust fans or open the windows located in the bathrooms to help prevent a build-up of moisture in those areas.

Mold remediation: Deciding when to call a Professional

Can you clean up mold yourself? **Yes**, but you should realize that there will be a significant difference in the approach used for small amounts of mold in a sink cabinet and a large,

contaminated area, such as mold growing in the walls. According to the Environmental Protection Agency (EPA), a homeowner wearing personal protective equipment may handle small cleanup areas. For larger areas, the EPA advises hiring an experienced, professional contractor. Any home that has sustained major water damage or flooding needs to be inspected by a qualified water loss specialist.

If you decide to take on the task yourself, remember that you will be exposed to potentially toxic mold and strong detergents and disinfectants. Disinfecting agents can also be toxic to humans. They should be used only when necessary and should be handled with caution. Disinfectants should only be applied to thoroughly cleaned materials.

Do not use disinfectants instead of, or before, cleaning with soap or detergent. Take steps to protect human health during any cleanup. Remove and discard moldy items as soon as possible to prevent further release of spores. Ask family members or bystanders to evacuate areas that are being cleaned and minimize exposure to disinfectants. Contain and thoroughly ventilate the work area. Wear protective clothing that is easily cleaned or discarded, and use rubber gloves. Wear a respirator with a P-100 filter to prevent inhalation of airborne spores. Use non-ammonia soap or detergent, or a commercial cleaner, in hot water, and scrub the entire area that is affected by the mold. Use a stiff brush or cleaning pad on cement-block walls or rough surfaces.

Make sure the entire surface is wet, and allow the disinfectant to remain on the surface for the prescribed time before rinsing. Rinse the items, dispose of any sponges or rags used to clean the mold, and properly dispose of extra disinfectant and runoff. The cleaned areas and house should be thoroughly dried and ventilated for several days after the work. If mold returns after a cleanup, it may indicate an undetected problem, such as a leak. If mold contamination is extensive or if you are unsure of yourself during the cleaning process, consult a professional mold abatement company.

D) <u>Radon</u> - *What is it?*

Radon is a radioactive gas. It’s colorless, odorless, tasteless, and chemically inert. Unless you test for it, there is no way of telling how much is presently in your home.

Radon is formed by the natural radioactive decay of uranium in rock, soil, and water. Naturally existing, low levels of uranium occur widely in the Earth's crust. It can be found in all 50 states. Once produced, radon moves through the ground to the air above. Some remains below the surface and dissolves in water that collects and flows under the ground's surface.

Radon has a half-life of about four days - half of a given quantity of it breaks down every four days. When radon undergoes radioactive decay, it emits ionizing radiation in the form of alpha particles. It also produces short-lived decay products, often called progeny or daughters, some of which are also radioactive. Unlike radon, the progeny are not gases and can easily attach to dust and other particles. Those particles can be transported by air and can also be breathed. The decay of progeny continues until stable, non-radioactive progeny are formed. At each step in the decay process, radiation is released.

PART 8

What health effects are associated with radon exposure?

There have been no reports of short-term effects or symptoms caused by radon exposure. The only reported long-term effect is **lung cancer**. The Surgeon General has warned that radon is the second leading cause of lung cancer in the United States. There are currently no conclusive data on whether children are at greater risk than adults from radon. No specific subtype of lung cancer is associated with radon exposure. Scientists estimate that approximately 15,000 to 22,000 lung cancer deaths per year are related to radon.

Radon is present in nearly all air. Everyone breathes radon in every day, usually at very low levels. However, people who inhale high levels of radon are at an increased risk for developing lung cancer. If you inhale a radon atom, the atom can disintegrate while it is in your lungs. When it disintegrates, it becomes polonium-218, which is a metal. This metal atom can get trapped in your lungs, and over the next hour or so it will emit a number of alpha particles, beta particles and gamma rays.

It eventually turns into lead-210 with a half-life of 22 years, which is fairly stable in this context. But now you have an atom of lead in your system, which causes its own problems. It's the quick, hour-long sequence of alpha, beta and gamma emissions that can lead to the mutations in the lung tissue, which can cause lung cancer over the course of your lifetime.

Smoking enormously increases the risk of lung cancer from radon exposure. If you smoke and you are exposed to elevated radon levels, your risk of lung cancer is especially high. Stop smoking now and lower your radon level to reduce your lung cancer risk.

Not everyone exposed to elevated levels of radon will develop lung cancer, and the amount of time between exposure and the onset of the disease may be many years. Breathing radon does not cause any short-term health effects such as shortness of breath, coughing, headaches, or fever.

So, you can see that a high concentration of radon gas, despite the fact that it is completely natural, is not something you want in your home.

What is the "acceptable" level of radon in air?

EPA states that any radon exposure carries some risk; no level of radon exposure is always safe. However, EPA recommends homes be fixed if an occupant's long-term exposure will average…

4(four) Pico curies per liter (pCi/L) or higher.

How often is indoor radon a problem?

Nearly one out of every 15 homes in the United States has a radon level EPA considers to be elevated - 4 pCi/L or greater. The U.S. average radon-in-air level in single family homes is 1.3 pCi/L. Because most people spend as much as 90 percent of their time indoors, indoor exposure to radon is an important concern.

PART 8

How does Radon get into a home?

Most indoor radon comes into the building from the soil or rock beneath it. Radon and other gases rise through the soil and get trapped under the building. The trapped gases build up pressure. Air pressure inside homes is usually lower than the pressure in the soil.

Therefore, the higher pressure under the building forces gases though floors and walls and into the building. Most of the gas moves through cracks and other openings. Once inside, the radon can become trapped and concentrated.

Openings which commonly allow easy flow of the gases into your home:

- Cracks in floors and walls
- Gaps in suspended floors
- Openings around sump pumps and drains
- Cavities in walls below grading
- Gaps around utility penetrations (pipes and wires)
- Crawl spaces that open directly into the building

Radon may also be dissolved in water, particularly well water. After coming from a faucet, about one ten thousandth of the radon in water is typically released into the air. The more radon there is in the water, the more it can contribute to the indoor radon level.

Trace amounts of uranium are sometimes incorporated into materials used in construction. These include, but are not limited to concrete, brick, granite, and drywall. Though these materials have the potential to produce radon, they are rarely the main cause of an elevated radon level in a building. Outdoor air that is drawn into a building can also contribute to the indoor radon level.

The average outdoor air level is about 0.4 pCi/L, but it can be higher in some areas. While radon problems may be more common in some geographic areas, any home may have an elevated radon level. New and old homes, well-sealed and drafty homes, and homes with or without basements can have a problem.

Radon levels can be higher in homes that are well insulated, tightly sealed, and/or built on uranium-rich soil. Because of their closeness to the ground, basement and first floors typically have the highest radon levels. All homes below the third floor of a multi-family building are particularly at risk.

Testing for Radon

Homes that are next door to each other can have different indoor radon levels, so using a neighbor's test result is a poor predictor of radon risk. In addition, precipitation, barometric pressure, and other influences can cause radon levels to vary from month to month or day to day, which is why both short- and long-term tests are available.

Testing is the only way to know if a person's home has elevated radon levels. Radon levels within a building often change on a day-to-day basis. Highest indoor levels are often found

during the heating season. Weather conditions, operation of furnaces and fireplaces, and opening/closing of windows and doors are among the factors that cause these patterns.

EPA recommends initial measurements of radon to be short-term tests placed in the lowest lived-in level of your home. I do carry these recommended short-term test kits and can be purchased for $35.00 per canister. These kits are the quickest and most efficient way to test for high radon levels in any home. These particular kits should remain in the home for 48 hours. If testing, please read the literature "Your Radon Test" that I have included with your report.

Short-term testing under closed-building conditions helps to ensure that residents quickly learn if a home contains very high levels of radon. All windows and outside doors should remain closed in this testing area. If radon test kits are placed in your prospective home, I will inform the Sellers to keep all windows and doors closed as much as possible while your test kits are in place. It's always good if your Realtor would notify the sellers Realtor to request that the Sellers close their windows and outside doors at least 12 hours before beginning the test. I recommend that you not conduct Radon tests during unusually severe storms or periods of unusually high winds.

One Canister or two?

Massachusetts Home Inspections recommends that you place two canisters in the home. If you decide to place only one canister and the test results come back as dangerously high, my lab may request that you purchase two additional canisters in order to obtain an average reading amongst the two of them combined.

Because radon levels may fluctuate by as much as a factor of two or three Pico curies, additional testing is sometimes recommended to better assess the average radon level in the home.

How does radon get into your water?

When the ground produces radon, it can dissolve and accumulate in water from underground sources (called ground water), such as wells. When water that contains radon is run for showering, washing dishes, cooking, and other uses, radon gas escapes from the water and goes into the air. Some radon also stays in the water.

Radon can be a concern if your drinking water comes from a well that draws from an underground source, though not all water from underground sources contains radon. If you get your water from a public water system that serves 25 or more year-around residents, you should receive an annual water quality report. These water quality reports include information on what is in your water, including radon if it has been tested.

Radon from lakes, rivers, and reservoirs (called surface water) is of much less concern. Most of the radon is released from the water before it enters the distribution system.

Radon gas can enter the home through well water. It can be released into the air you breathe when water is used for showering and other household uses. Research suggests that swallowing

water with high radon levels may pose risks, too, although risks from swallowing water containing radon are believed to be much lower than those from breathing air containing radon.

While radon in water is not a problem in homes served by most public water supplies, problems have been found in well water. If you've tested the air in your home and found a radon problem, and your water comes from a well. Massachusetts Home Inspections will gladly take a water sample and have our local certified Lab determine if radon exists in your well water. I can get the results back to you within two working days.

Lowering radon levels in your home

A variety of methods are used to reduce radon levels. In some cases, sealing cracks in basement floors and walls may help. In other cases, simple systems using pipes and fans may be used to reduce radon. Such systems are called "sub-slab depressurization," and do not require major changes to your home. These systems remove radon gas from below the concrete slab before it can enter your home. Similar systems can also be installed in houses with crawl spaces. Radon contractors may use other methods depending on the design of your home.

You already have a Radon mitigation system installed

I recommend that you test for Radon levels annually to verify that your system is operating correctly. I can drop off test kits at your residence any time of the year.

Just call me and I'll gladly stop by and place a short term test kit in your home. Until then, I recommend that you monitor the pressure gauge that is built into the side of the Radon piping in your basement. The U-shaped vial should have two different levels of liquid in them, one high and one low. If you find that these two liquid lines are level with each other. This is a sign that the built-in fan is inoperative. I recommend that you contact the installation company immediately. There should be a contact number right next to the vial.

Test before you renovate

If you are planning to make any major structural renovations to your new home, such as converting an unfinished basement area into a living space, it is important to test the area for radon before you begin the renovation. If your test results indicate a radon problem, radon-resistant techniques can be inexpensively included as part of the renovation. Because major renovations can change the level of radon in any home, always test again after work is completed.

For more information concerning radon, you should browse the EPA website at
http://www.epa.gov/radon/index.html

PART 8

WOOD BORING INSECTS

Wood Boring Insects infest more than 700,000 homes each and every year. Your home is your biggest financial investment, and protecting it against Wood Boring Insects should be a high priority. Left unchecked, insects can systematically destroy your home and any valuable wood objects within it. Nonetheless, any discovery of insects in your home means making some difficult choices as to what steps to take in order to prevent further damage.

A WBI inspection is usually a big deal for any one of my clients. If your home inspection included a WBI inspection, please review your WBI report to determine if evidence of insect activity was found on your prospective property. If evidence of Wood Boring Insect activity was noted, I recommend an exterminator be contacted for treatment ASAP and to have a licensed Carpenter evaluate and estimate repairs for replacement of damaged areas to include determining if hidden damage exists behind any finished walls.

A) Termites

Of all Wood Boring insects, Termites are definitely the most damaging wood destroying insects out there. Did you know that the average single-family home has as many as four termite colonies beneath it (and each colony has as many as 1 million winged residents). You want to prevent these colonies from attacking your home.

The smallest of cracks in your foundation -- usually a basement or concrete slab -- is enough for those sneaky termites to gain entry into your home. And once they're inside, anything made of wood -- from door frames to floors to furniture -- is fair game. You can't always see termites because they feed undetected. Termite workers attack the wood in your home from the inside out and infestations can go undiscovered until the wood is almost completely destroyed, which could take years.

As if this scenario weren't bad enough, after they feast on wood, termites leave behind a chemical trail that sends signals to other termites that food is near. Once started, this trail of destruction is impossible to stop without the services of a professional exterminator who is skilled at locating the hidden regions of your home where these termites take up residence. Wood-boring insects are difficult to control by homeowners once an infestation has begun. Treating insects is not a do-it-yourself project. If you have signs of Termite activity, do yourself a favor, hire a professional

What are termites attracted to, besides wood? It's Moisture. It's extremely difficult to ward off moisture throughout your home, and especially underneath it, where termites gain initial entry to your property. The good news is that in many cases, the problem starts in areas you can reach -- outside and around your home, where wood products are exposed to the elements and thus trap moisture. Prevention is the best management method.

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Here's How to protect your Home against Termites:

- Above all, schedule an annual termite inspection and watch for mud tubes over exposed exterior surfaces of your home and swarming termites in April & May.
- Trim all shrubs, bushes, vines and other dense greenery away from the foundation and the siding of your home.
- So many homeowners collect piles of firewood outside their homes come wintertime. But some of us who don't use the entire pile let it sit throughout the rest of the year. This does you no good for many reasons. First, the firewood begins to rot as it's exposed to changes in the weather; second, it's ultimately useless because it becomes wet with moisture; and third (and most important), it's a magnet for termites seeking a home. You'll obviously need to store some firewood outdoors during the winter months -- particularly if you light fires often -- so your best bet is to keep the pile raised off the ground and away from the side of your house.
- Consistent with the reasoning of the above-listed point, remove all lumber, tree stumps and any other variety of wood from the parameters of your home. If you're saving some wood for that home-improvement project you're planning to tackle on a rainy day, store it in your garage in a high and dry area. No wood should be touching the ground around your house, period. Including exterior finishes of your home. These areas should be 6 to 8 inches above grading.
- This includes removal and replacement of any wood posts or stair stringers that penetrate any concrete floor or rest on dirt in the basement or crawl space of a Post and Beam foundation. These penetrations will only invite Termites and provide avenues for their passage to more appetizing segments of the structure.
- If you've got leaky pipes or any accumulation of water underneath your home, call a professional (or tackle the job yourself if you're capable). If you've been putting off the job, don't stall any longer. You may already have attracted termites to the water. By the same token, if you find standing water anywhere -- inside or outside your home -- get rid of it immediately. (Please read Part 5B-"**Foundations**-Wet Basements" in this manual.)
- Clean your gutters and downspouts regularly. Clogs and other obstructions can attract termite populations. Inspect your gutters regularly for signs of disrepair. Inspect your home's crawl space. It may be in your best interest to determine if the space is properly protected in order to stave off termites. Moisture and humidity in crawl spaces can be reduced by installing 4-6 ml polyethylene sheeting over the soil surface. This cover will act as a vapor barrier to reduce evaporation from the soil and condensation of moisture on joists and sub flooring. (Please read Part 5G -"**Foundations**-Your Crawl space" in this manual)
- Since termites can prey on the outside of your home, inspect your home regularly for any foundation cracks. If you find cracks inside or outside, seal them immediately. Ensure that your home receives continual maintenance to keep its exterior paint in good condition. Chipping, peeling paint can increase the likelihood of termite infestation.

As a homeowner, you can never prevent termite infestation with 100 percent certainty. However, you can take these various measures to decrease the probability of infestation

in your home. Considering both the cost of damage and inspection/extermination, you have absolutely nothing to lose by trying every one of these precautions. Yes, it is true that termites may find a meal at your house. But they are not the only pests ready to eat your house.

B) Powder Post Beetles

Powder post beetles are usually brought into buildings inside lumber which has been stored in yards or at building sites. They may also be present in furniture, wood paneling, and firewood. Damage is usually to the starch-rich sapwood of large-pored hardwoods such as ash, hickory, oak, walnut and cherry. The hardwood floors of new homes are commonly attacked.

One family of powder post beetles, the anobiids, prefers damp wood and thus is more common in coastal areas or in situations where wood is allowed to remain damp. Another group prefers seasoned hardwood (like furniture) and may require many years to complete development. Old furniture can suddenly develop exit holes! More commonly, exit holes begin showing up in trim wood around cabinets and along baseboards one to several years after manufacture.

You can easily recognize the work of powder post beetles. When the adults emerge, usually in June, some species leave small holes about the size of a pin in the surface of the wood; others make holes the size of pencil lead. From these holes, a fine, powder like brood of larvae carry on their destructive feeding. Normally, these insects have a 1-year life cycle; this means that the adults will appear only once each year. And because of this habit the larvae have a feeding period of many months.

Powder Post Beetle Prevention

- As I stated earlier, where excess moisture is a problem, all efforts to correct the cause should be undertaken. It does, however, take wood a long time to dry out, and reducing moisture may not be enough to completely control powder post beetle infestations.
- If your house sits on a crawl space, or has a dirt basement, I recommend covering the earth with 4-6 ml polyethylene sheeting to reduce the moisture in this area. Watch the surface of the sheeting for sawdust falling from floor joists above.
- Inspect the floor or moldings beneath interior wood walls. Little piles of sawdust indicate beetles have been in the wood, but are not necessarily a sign of active infestation.
- Schedule annual inspections with a qualified licensed inspector.

C) Carpenter Ants

An ant infestation is not as devastating as termites, but does require careful attention to avoid structural failures that can result from their tunneling into your home. Unlike termites, ants do not eat wood for its nutritional value. They burrow into the wood to

make their nest. Most species start their nests in any moist wood that has begun to decay around the parameter of the house. They commonly nest in wood retaining walls, wet porches/decks, dead portions of standing trees, stumps, logs. They attack both hardwoods and softwoods, but normally they do not cause extensive structural damage.

Carpenter Ant Prevention

The first step in carpenter ant control should always include mechanical modifications to the structure and environment. The object is to reduce the avenues available for carpenter ants to enter a home or structure, as well as removing possible food and water sources.

- If any tree limbs are in contact with the roof, cut them back. Carpenter ants can easily drop to a structure from tree limbs as high as five feet above the roof.
- Move firewood away from the house as you would for Termites.
- Seal cracks along foundations, siding, windows and doors with caulk and install fine mesh screens over crawl space and attic vents.
- Ants need water in addition to food and eliminating sources of water will make an area less hospitable to carpenter ants. If necessary, fix plumbing leaks, insulate sweating pipes, reroute air conditioner drains and make sure sprinkler heads are properly adjusted.
- Be sure to keep your house free from any sweets or grease that might distract the ants. If you start to see ants, place containerized bait near a suspected ant trail; put liquid bait in cracks and void areas where ants have been seen. The first sign that the bait is working is an increase in the number of ants.
- Do not kill any ants, as they must bring the bait back to the colony where it can be effective. The entire population should decrease eventually.
- Do not spray any insecticides once you have placed a bait. Doing so could make the bait ineffective or kill the worker ants that must transport the bait.

D) Carpenter Bees

Carpenter bees are large, black and yellow bees frequently seen in spring hovering around the eaves of a house or the underside of a deck or porch rail. They are most often mistaken for bumble bees, but differ in that they have a black shiny tail section. The carpenter bee is so-called because of its habit of excavating tunnels in wood surfaces with its strong jaws. Carpenter bees, like their distant relatives, the carpenter ants, differ from termites in that they do not consume the wood as food. They simply excavate tunnels for nesting sites. They can become a nuisance outdoors when they fly very erratically (hover) around the heads of people, causing fear, however, males cannot sting and females can sting but she is normally very docile.

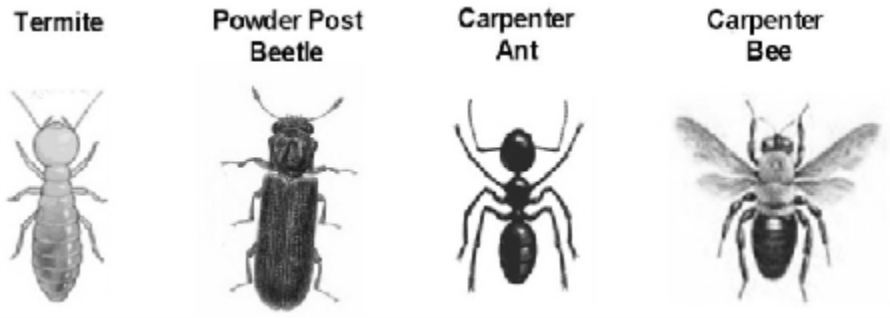
Homeowners complain not only about the aggressive nature, but about the round holes bored into wood trim near eaves and gables of homes, fascia boards, porch ceilings, outdoor wooden furniture, decks, siding and window frames. Initial damage is minor, but

new tunnels may be excavated and old ones enlarged, causing considerable wood damage. The yellow, coarse sawdust from borings beneath their entry holes contain their waste materials, leaving unsightly stains.

The males and females cut a one-half inch circular hole into the wood, and then create a tunnel parallel to the surface of the wood. The female carpenter bee will turn 90 degrees and bore a channel from 6 inches to as long as 4 feet. This channel serves as a main corridor from which she will drill small chambers a few inches deep. These chambers become egg holders. She will deposit an egg, bring in a mass of pollen for the newly hatched larvae to feed on, and then seal it all off to ensure its development before she repeats the process for the next egg.

Carpenter Bee Prevention

Preventing carpenter bee damage is difficult (or nearly impossible) for several reasons. Protective insecticide sprays applied to wood surfaces are effective for only a short period even when repeated every few weeks. Since the bees are not actually eating the wood and they are active over several weeks, they are rarely exposed to lethal doses of the pesticide. Second, since virtually any exposed wood on the house could be attacked, it is difficult and usually impractical and unsafe to try applying a pesticide to all possible sites where the bees might tunnel. Lastly, trying to spray bees that are seen hovering about is not a sensible (or particularly safe) use of pesticides either. Swatting hovering bees will often prove to be just as effective.
If possible, susceptible exterior parts of a building should be constructed out of hardwoods not normally attacked by the bees for nests. On all buildings, fill depressions and cracks in wood surfaces so they are less attractive. Paint or varnish exposed surfaces regularly to reduce weathering. Fill unoccupied holes with steel wool and caulk to prevent their reuse. Wait until after bees have emerged before filling the tunnels. Once filled, paint or varnish the repaired surfaces. Protect rough areas, such as ends of timbers, with wire screening or metal flashing.



LIFE EXPECTANCY TABLE

APPLIANCES

Compactor - 10 years.
Dishwasher - 10 years.
Garbage Disposer - 10 years.
Clothes Dryer - 13 years.
Freezer (compact) - 12 years.
Freezer (standard) - 16 years.
Microwave Oven - 11 years.
Range (freestanding and built-in, electric) - 17 years.
Range (freestanding and built-in, gas) - 19 years.
Range (high oven, gas) - 14 years.
Refrigerator (compact) - 14 years.
Refrigerator (standard) - 17 years.
Washer (automatic and compact) - 12 years.
Exhaust Fans - 20 years.

BATHROOM FIXTURES

Cast Iron bathtub – 50+ years.
Fiberglass bathtub and shower - 10-15 years.
Shower door (average quality) - 25 years.
Toilet - 50 years.

CABINETS

Kitchen cabinets - 15-20 years.
Medicine cabinet/bath vanity - 20 years.

COUNTERTOPS

Laminate - 10-15 years.
Ceramic tile (high grade installation) - Lifetime.
Wood/butcher block - 20+ years.
Granite - 20+ years.

DOORS

Screen - 25 - 50 years.
Interior (not perfect hollow core) - <30 years to life.
Interior (solid core) - 30 years to life.
Exterior (protected overhang) - 80-100 years.
Exterior (unprotected and exposed) - 25-30 years.
Folding - 30 years to life.
Garage door - 20 - 50 years.
Garage door opener - 10 years.

FLOORS

Oak or pine - Lifetime
Slate flagstone - Lifetime
Vinyl sheet or tile - 20-30
Terrazzo - Lifetime
Carpeting - 11 years
Marble - Lifetime

FOOTINGS & FOUNDATIONS

Poured footing & foundation - 200 years.
Concrete block - 100 years.
Cement - 50 years.
Waterproofing (bituminous coating) - 10 years.
Termite proofing - 5 years.

HEATING, VENTILATION & AIR CONDITIONING

Air conditioning unit (central) - 15 years.
Air conditioning unit (window) - 10 years.
Baseboard heat units - 20 years.
Humidifier - 8 years.
Water Heater (electric) - 14 years.
Water Heater (gas) - 11 - 13 years.
Forced air furnace, heat pump - 15 years.
Furnace, gas or oil fired - 18 years.

LANDSCAPING

Wooden deck (treated) 25 years.
Brick and concrete patio - 24 years.
Tennis court - 10 years.
Concrete walk - 24 years.
Gravel walk - 4 years.
Asphalt driveway - 10 years.
Swimming pool - 18 years.
Sprinkler system - 12 years.
Fence - 12 years.

PAINTS & STAINS

Exterior paint on wood, brick and aluminum - 5-8 years.
Interior wall paint - 5-10 years.
Interior trim and door paint - 5-10 years.
Interior wallpaper - 7 years.

PLUMBING

Faucets (low quality) - 13-15 years.
Faucets (high quality) 15-20 years.
Sinks (enamel steel sink) - 5-10 years.
Sinks (enamel cast iron sink) - 25-30 years.
Sinks (Porcelain sink) - 25-30 years.
Waste pipe (cast iron) - 75-100 years.

ROOFING

Wood shingles and shakes - 15-35+ years.
Asphalt composition shingle - 15-20 years.
Asphalt architectural shingle - 25-30 years.
Roll roofing (asphalt) - 10-12 years.
Built-up roofing (coat and tar) - 12-30 years.
Gutters and downspouts - 25 years.
Slate - 50-100+ years.
Clay tiles – 20+ years.

SIDING

Wood Siding – 10 years if constantly moist and
100 years if properly maintained.
Aluminum Siding - 20-50 years.
Steel Siding - 50 years to Life.
Vinyl Siding - 50 years.

WINDOWS

Aluminum casement - 10-20 years.
Vinyl casement – 10-20 years.
Wood casement - 20-50 years.
Window glazing - 20 years.
Screens - 25 - 50 years

NOTES