- **Identifying Common Issues and Symptoms of residential foundations**
  Identifying Common Issues and Symptoms of residential foundations Spotting Early Warning Signs of Foundation Stress Recognizing Cracks and Shifts in Concrete Floors Understanding Sticky Doors and Window Alignment Pinpointing Sinking Spots around the Foundation Perimeter Tracking Water Intrusion as a Contributor to Structural Damage How Uneven Floors Reveal Deeper Foundation Concerns Identifying Subtle Changes in Exterior Walls When Hairline Drywall Cracks Indicate Movement Monitoring Seasonal Soil Movement for Foundation Clues Evaluating Soil Erosion and Its Impact on Stability Noting Shifting Porches and Deck Attachments Examining Sloping Floors for Underlying Settlement
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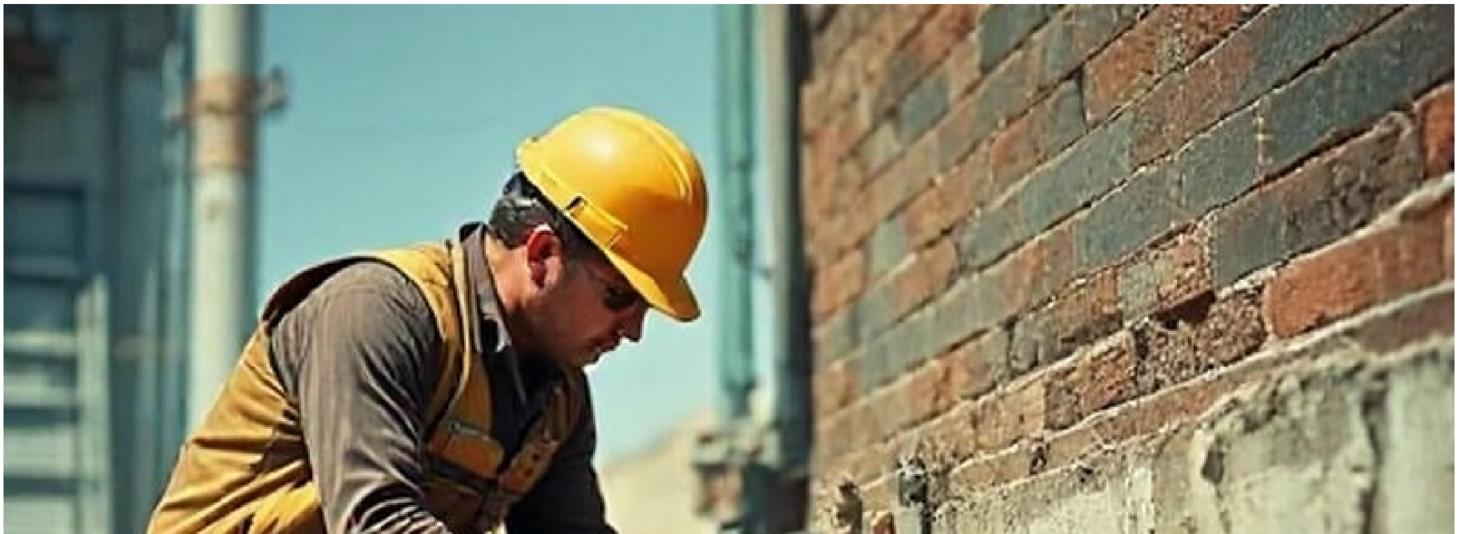

* Understanding the Connection Between Groundwater and Foundation Problems.

Okay, so we're talking about groundwater and how it messes with our house foundations, right? Foundation drainage solutions help prevent water-related damage foundation crack repair service safety. It's not something most people think about until they see a crack or a sag, but trust me, understanding the link is key to keeping your home happy (and upright!).

Think of your house's foundation like a ship at sea. A stable sea level (or in this case, groundwater level) is fine. But imagine the tide constantly going in and out, soaking the ship's hull and then drying it out. That constant wet-dry cycle is what kills a foundation.

When groundwater levels fluctuate, the soil around your foundation expands when it's wet and shrinks when it's dry. This isn't a uniform process, mind you. Some areas will expand more than others, putting uneven pressure on the foundation. Over time, this leads to cracks, settling, and all sorts of structural headaches.

Now, when we're talking about "Evaluating Groundwater Levels for Long Term Stability," we're basically trying to predict the tide. We want to know if the groundwater level is generally stable, or if it's prone to wild swings. This involves looking at things like rainfall patterns, soil types, drainage, and even nearby bodies of water. Knowing this helps us determine the risk to your foundation.

If the evaluation shows unstable groundwater, there are things you can do. Improving drainage around the house, installing a sump pump, or even reinforcing the foundation itself can help mitigate the risks. It's all about understanding the problem and taking proactive steps to protect your home. Ignoring it just means bigger, more expensive problems down the road. So, pay attention to the water; your foundation will thank you.

* Assessing Local Hydrogeology & Historical Groundwater Data.

Okay, so we're talking about groundwater levels, right? And trying to figure out if they're going to stick around for the long haul. You can't just wave a magic wand and say "yep, looks stable!" You've got to dig in – literally and figuratively. That's where "Assessing Local Hydrogeology & Historical Groundwater Data" comes into play.

Think of it like this: the hydrogeology is the lay of the land, but underground. What kind of rocks and soils are there? Are they porous, like a sponge, letting water flow easily? Or are they tight and impermeable, like clay, blocking the flow? Knowing the hydrogeology tells you *how* water moves in the area. Is there a big aquifer under your feet, a smaller perched one, or just a bunch of disconnected pockets? This is crucial because it dictates how quickly the groundwater can recharge (be refilled) and how easily it can be depleted.

Then there's the historical groundwater data. This is like looking at the patient's medical history. You need to know what the water levels have been doing over time. Are they trending downwards over the past decade? Have there been significant drops during droughts, and how quickly do they recover?

Are there seasonal fluctuations? This historical data gives you a sense of the *pattern* of groundwater levels, showing you how they respond to rainfall, pumping, and other influences.

Putting these two pieces together – the hydrogeology and the historical data – lets you paint a much clearer picture. You can start to understand *why* the water levels are behaving the way they are. Maybe the aquifer is naturally slow to recharge because of the surrounding geology, or maybe heavy pumping for irrigation is causing a long-term decline. Without both pieces of information, you're just guessing. You're essentially trying to predict the future of something you don't fully understand. By carefully analyzing this data, you can make a much more informed assessment of the long-term stability of those groundwater levels. It's not a perfect crystal ball, but it's the best tool we've got.

* Methods for Measuring and Monitoring Groundwater Levels.

Okay, so we're talking about keeping an eye on groundwater levels, right? Making sure they're not just randomly bouncing around, but staying relatively stable over the long haul. That means we need ways to actually *measure* and *monitor* what's going on down there. It's not like you can just stick a ruler in the dirt and call it a day.

The most common method, and probably the one you'll hear about most often, involves wells – observation wells, specifically. These are like dedicated listening posts drilled into the aquifer. You can lower a water level meter down the well to get a reading. Some meters are simple, like a weighted tape that beeps when it hits the water. Others are fancier pressure transducers that continuously record the water level and can even transmit the data wirelessly. Think of it like having a tiny submarine sending back reports on the water level, only it's stuck in a well.

Now, just taking a single measurement isn't going to tell you much about long-term trends. That's where *monitoring* comes in. Monitoring means taking regular measurements over time – weeks, months, even years. Ideally, you'd want a network of these observation wells strategically placed across the area you're interested in. That gives you a comprehensive picture, not just a single data point.

Beyond wells, there are also indirect methods. For example, we can look at surface water features like springs and streams. If a spring dries up or a stream's flow decreases significantly, it could be a sign that the groundwater level is dropping. It's not a direct measurement, but it's a clue. Also, satellite-based techniques like GRACE (Gravity Recovery and Climate Experiment) can detect changes in groundwater storage over large areas. These are great for getting a regional overview, though they might not provide the fine-grained detail you get from individual wells.

The key takeaway is that effective groundwater monitoring is about combining different methods to get a complete and accurate picture. It's not just about the tools themselves, but also about how you use them – where you place your wells, how often you take measurements, and how you interpret the data. And that data, properly analyzed, is what allows us to assess whether groundwater levels are indeed stable, or if we need to start worrying about things like over-pumping or climate change impacts. It's a vital piece of the puzzle for managing this precious resource sustainably.

* Identifying Fluctuations and Trends in Groundwater.

Do not use any bullet points. Do not use any numbered lists.

Okay, so you're looking at groundwater levels, right? Trying to figure out if things are stable for the long haul. That's where "Identifying Fluctuations and Trends in Groundwater" comes into play. Think of it like this: groundwater isn't just sitting still. It's breathing, in a way. Levels go up and down, responding to rainfall, pumping, even the seasons. Just like watching the stock market, you can't just look at one day's number and declare success or failure. You need to see the bigger picture.

Identifying fluctuations means understanding those ups and downs. Are they small, normal variations, or are we talking about dramatic swings? Big dips after a dry summer are expected, but consistently lower levels year after year? That's a red flag. Trends are the long-term direction things are moving in. Is the water table slowly but surely declining, or is it holding steady, maybe even rising? Figuring this out is key to knowing if your groundwater resource is sustainable.

How do you do it? Well, you need data. Lots of it. Regular measurements of water levels over time, preferably many years. Then you start looking for patterns. Are there seasonal cycles? Are there periods of drought or heavy rainfall that clearly impact the levels? Are there any long-term changes that can't be explained by natural variability? Maybe increased pumping is the culprit, or perhaps land use changes are affecting recharge.

Ultimately, identifying these fluctuations and trends is crucial because it helps you predict the future. If you see a clear downward trend, you can take action to prevent further decline. Maybe you need to reduce pumping, implement water conservation measures, or find alternative water sources. Ignoring these signals is like ignoring a leaky faucet – it might not seem like much at first, but it can lead to serious problems down the road. So, pay attention to the fluctuations and trends. They're telling you a story about the health and stability of your groundwater.

*** Interpreting Groundwater Data for Foundation Stability Risk.**

Okay, let's talk about groundwater and why it matters when we're building stuff that's supposed to stay put for a long time. Imagine trying to build a sandcastle at the beach. If the sand is dry, it crumbles. If it's soaking wet, it's a gloopy mess. The sweet spot is that just-right dampness, right? Well, the ground our buildings sit on is kinda the same way, and groundwater is the moisture content we need to pay serious attention to.

When we're evaluating long-term stability of a building's foundation, ignoring groundwater is like forgetting to bring sunscreen to the beach – you're gonna regret it. We need to get our hands dirty with "Interpreting Groundwater Data for Foundation Stability Risk." What does that mean? It's about understanding what the water under our feet is doing. Is the water table high, meaning the ground is constantly saturated? Is it fluctuating wildly with the seasons, like a tide coming in and out? Or is it relatively stable, a nice, consistent dampness?

The thing is, all that groundwater data – those measurements from wells, those soil samples, those fancy computer models – it's just numbers until we interpret them. We need to figure out if the water is going to cause problems. High water tables can weaken the soil, making it less able to support the building's weight. Fluctuations can cause expansion and contraction, leading to cracks in the foundation. And chemical reactions between the groundwater and the foundation materials can lead to corrosion and deterioration over time.

So, interpreting groundwater data isn't just about looking at numbers. It's about painting a picture of what's happening underground and predicting how that picture will change over the long haul. It's about understanding the risk to our foundations and making smart decisions to mitigate that risk. It's the difference between a sandcastle that stands tall for the whole afternoon, and one that collapses with the next wave. Ultimately, it's about making sure that the buildings we build today are still standing strong for generations to come.

* Implementing Preventative Measures and Mitigation Techniques.

Evaluating groundwater levels for long-term stability isn't just about knowing how high or low the water table is today. It's about understanding the *future* of that precious resource. And that's where "implementing preventative measures and mitigation techniques" comes into play. Think of it like this: you've just gotten a weather report predicting a drought. Do you sit around and hope it doesn't happen, or do you start conserving water and preparing for the worst? Groundwater management is the same principle.

Preventative measures are the proactive steps we take to avoid problems in the first place. This might include things like carefully managing land use in recharge zones, restricting groundwater pumping in vulnerable areas, or promoting water-efficient irrigation practices. The goal is to maintain a healthy balance between water extraction and natural replenishment. It's about sustainable use, ensuring that future generations have access to this vital resource. Imagine a farmer switching to drip irrigation instead of flood irrigation. That's a preventative measure – using water more efficiently to reduce overall demand on the aquifer.

Now, even with the best preventative efforts, sometimes things go wrong. Climate change might bring prolonged droughts, or unexpected pollution events could contaminate a water source. That's where mitigation techniques come in. Mitigation is all about lessening the negative impacts of something that's already happening or is likely to happen soon. This might involve things like constructing artificial recharge basins to replenish depleted aquifers, developing alternative water sources (like rainwater harvesting or desalination), or implementing water restrictions during periods of scarcity. Think of it as having a backup plan. If the well starts to dry up, what are you going to do?

Ultimately, effective groundwater management requires a combination of both preventative and mitigation strategies. It's about being both proactive and reactive, anticipating potential problems and having solutions ready to go. It's not a "set it and forget it" situation. It requires continuous monitoring, evaluation, and adaptation to changing conditions. Only then can we truly ensure the long-term stability of our groundwater resources.

* The Role of Drainage Systems in Groundwater Management for Foundations.

Alright, let's talk about keeping our buildings sturdy, specifically how drainage plays a crucial role in managing groundwater and ensuring our foundations stay put for the long haul. Think of your house, or any building, really. Its foundation is its anchor, right? But that anchor can be seriously compromised if it's constantly battling against rising groundwater. That's where drainage systems come in, acting like a vigilant guard against waterlogged woes.

When we're evaluating groundwater levels for long-term stability, we're essentially asking: "Is this foundation going to be swimming in groundwater in five years? Ten years? Fifty?" If the answer is potentially yes, even intermittently, we've got a problem. Excessive groundwater can exert hydrostatic pressure, pushing against foundation walls and floors, leading to cracks, leaks, and even structural failure. It can also contribute to soil instability, causing the ground beneath the foundation to shift and settle unevenly. Not good.

Drainage systems are designed to intercept and redirect this potentially damaging groundwater. Think of French drains, perimeter drains around the foundation, or even more complex systems depending on the site conditions. These systems effectively lower the water table around the foundation, relieving that hydrostatic pressure and preventing water from seeping into the building.

But it's not just about installing a drain and forgetting about it. The long-term stability hinges on properly designed, installed, and *maintained* drainage systems. We need to consider things like the permeability of the surrounding soil, the volume of groundwater expected (based on historical data and projected climate changes), and the capacity of the drainage system itself. A poorly designed or clogged drainage system is just as bad – maybe even worse – than having no system at all, because it can create localized areas of concentrated water buildup.

So, when we're evaluating groundwater levels and thinking about long-term foundation stability, the drainage system isn't just an afterthought; it's a key component of the entire equation. It's the unsung hero, quietly working to protect our buildings from the relentless forces of nature. Ignoring its importance is a recipe for costly repairs and potential structural damage down the road. Let's keep our foundations dry and our buildings standing tall!

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Residential Foundation Repair Services

Strong Foundations, Strong Homes

About Water damage

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Interior of part of a damaged home in New Orleans after Hurricane Katrina

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Family photographs damaged by flooding

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A smaller and more minor water spot caused by rainwater leaking through a roof

Water damage describes various possible losses caused by water intruding where it will enable attack of a material or system by destructive processes such as rotting of wood, mold growth, bacteria growth, rusting of steel, swelling of composite woods, de-laminating of materials such as plywood, short-circuiting of electrical devices, etc.

The damage may be imperceptibly slow and minor such as water spots that could eventually mar a surface, or it may be instantaneous and catastrophic such as burst pipes and flooding. However fast it occurs, water damage is a major contributor to loss of property.

An insurance policy may or may not cover the costs associated with water damage and the process of water damage restoration. While a common cause of residential water damage is often the failure of a sump pump, many homeowner's insurance policies do not cover the associated costs without an addendum which adds to the monthly premium of the policy. Often the verbiage of this addendum is similar to "Sewer and Drain Coverage".

In the United States, those individuals who are affected by wide-scale flooding may have the ability to apply for government and FEMA grants through the Individual Assistance program.[1] On a larger level, businesses, cities, and communities can apply to the FEMA Public Assistance program for funds to assist after a large flood. For example, the city of Fond du Lac Wisconsin received $1.2 million FEMA grant after flooding in June 2008. The program allows the city to purchase the water damaged properties, demolish the structures, and turn the former land into public green space.[*citation needed*]

Causes

[edit]

Water damage can originate by different sources such as a broken dishwasher hose, a washing machine overflow, a dishwasher leakage, broken/leaking pipes, flood waters, groundwater seepage, building envelope failures (leaking roof, windows, doors, siding, etc.) and clogged toilets. According to the Environmental Protection Agency, 13.7% of all water used in the home today can be attributed to plumbing leaks.[2] On average that is approximately 10,000 gallons of water per year wasted by leaks for each US home. A tiny, 1/8-inch crack in a pipe can release up to 250 gallons of water a day.[3] According to *Claims Magazine* in August 2000, broken water pipes ranked second to hurricanes in terms of both the number of homes damaged and the amount of claims (on average $50,000 per insurance claim[*citation needed*]) costs in the US.[4] Experts suggest that homeowners inspect and replace worn pipe fittings and hose connections to all household appliances that use water at least once a year. This includes washing machines, dishwashers, kitchen sinks, and bathroom lavatories, refrigerator icemakers, water softeners, and humidifiers. A few US companies offer whole-house leak protection systems utilizing flow-based technologies. A number of insurance companies offer policyholders reduced rates for installing a whole-house leak protection system.

As far as insurance coverage is concerned, damage caused by surface water intrusion to the dwelling is considered flood damage and is normally excluded from coverage under traditional homeowners' insurance. Surface water is water that enters the dwelling from the surface of the ground because of inundation or insufficient drainage and causes loss to the dwelling. Coverage for surface water intrusion[5] to the dwelling would usually require a separate flood insurance policy.

Categories

[edit]

There are three basic categories of water damage, based on the level of contamination.

Category 1 Water - Refers to a source of water that does not pose substantial threat to humans and classified as "**clean water**". Examples are broken water supply lines, tub or sink overflows or appliance malfunctions that involves water supply lines.

Category 2 Water - Refers to a source of water that contains a significant degree of chemical, biological or physical contaminants and causes discomfort or sickness when consumed or even exposed to. Known as "**grey water**". This type carries microorganisms and nutrients of micro-organisms. Examples are toilet bowls with urine (no feces), sump pump failures, seepage due to hydrostatic failure and water discharge from dishwashers or washing machines.

Category 3 Water - Known as "**black water**" and is grossly unsanitary. This water contains unsanitary agents, harmful bacteria and fungi, causing severe discomfort or sickness. Type 3 category are contaminated water sources that affect the indoor environment. This category includes water sources from sewage, seawater, rising water from rivers or streams, storm surge, ground surface water or standing water. Category 2 Water or Grey Water that is not promptly removed from the structure and or have remained stagnant may be re classified as Category 3 Water. Toilet back flows that originates from beyond the toilet trap is considered black water contamination regardless of visible content or color.[6]

Classes

[edit]

Class of water damage is determined by the probable rate of evaporation based on the type of materials affected, or wet, in the room or space that was flooded. Determining the class of water damage is an important first step, and will determine the amount and type of equipment utilized to dry-down the structure.[7]

Class 1 - Slow Rate of Evaporation. Affects only a portion of a room. Materials have a low permeance/porosity. Minimum moisture is absorbed by the materials. **IICRC s500 2016 update adds that class 1 be indicated when <5% of the total square footage of a room (ceiling+walls+floor) are affected **

Class 2 - Fast Rate of Evaporation. Water affects the entire room of carpet and cushion. May have wicked up the walls, but not more than 24 inches. **IICRC s500 2016 update adds that class 2 be indicated when 5% to 40% of the total square footage of a room (ceiling+walls+floor) are affected **

Class 3 - Fastest Rate of Evaporation. Water generally comes from overhead, affecting the entire area; walls, ceilings, insulation, carpet, cushion, etc. **IICRC s500 2016 update adds that class 3 be indicated when >40% of the total square footage of a room (ceiling+walls+floor) are affected **

Class 4 - Specialty Drying Situations. Involves materials with a very low permeance/porosity, such as hardwood floors, concrete, crawlspaces, gypcrete, plaster, etc. Drying generally requires very low specific humidity to accomplish drying.

Restoration

[edit]
See also: Convectant drying

Water damage restoration can be performed by property management teams, building maintenance personnel, or by the homeowners themselves; however, contacting a certified professional water damage restoration specialist is often regarded as the safest way to restore water damaged property. Certified professional water damage restoration specialists utilize psychrometrics to monitor the drying process.[8]

Standards and regulation

[edit]

While there are currently no government regulations in the United States dictating procedures, two certifying bodies, the Institute of Inspection Cleaning and Restoration Certification (IICRC) and the RIA, do recommend standards of care. The current IICRC standard is ANSI/IICRC S500-2021.[9] It is the collaborative work of the IICRC, SCRT, IEI, IAQA, and NADCA.

Fire and Water Restoration companies are regulated by the appropriate state's Department of Consumer Affairs - usually the state contractors license board. In California, all Fire and Water Restoration companies must register with the California Contractors State License Board.[10] Presently, the California Contractors State License Board has no specific classification for "water and fire damage restoration."

Procedures

[edit]

Water damage restoration is often prefaced by a loss assessment and evaluation of affected materials. The damaged area is inspected with water sensing equipment such as probes and other infrared tools in order to determine the source of the damage and possible extent of areas affected. Emergency mitigation services are the first order of business. Controlling the source of water, removal of non-salvageable materials, water extraction and pre-cleaning of impacted materials are all part of the mitigation process. Restoration services would then be rendered to the property in order to dry the structure, stabilize building materials, sanitize any affected or cross-contaminated areas, and deodorize all affected areas and materials. After the labor is completed, water damage equipment including air movers, air scrubbers, dehumidifiers, wood floor drying systems, and sub-floor drying equipment is left in the residence. The goal of the drying process is to stabilize the moisture content of impacted materials below 15%, the generally accepted threshold for microbial amplification. Industry standards state that drying vendors should return at regular time intervals, preferably every twenty-four hours, to monitor the equipment, temperature, humidity, and moisture content of the affected walls and contents.[6] In conclusion, key aspects of water damage restoration include fast action, adequate equipment, moisture measurements, and structural drying. Dehumidification is especially crucial for structural components affected by water damage, such as wooden beams, flooring, and drywall.

See also

[edit]

- Indoor mold

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[edit]

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About radon mitigation

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Radon mitigation is any process used to reduce radon gas concentrations in the breathing zones of occupied buildings, or radon from water supplies. Radon is a significant contributor to environmental radioactivity and indoor air pollution. Exposure to radon can cause serious health problems such as lung cancer.[1]

Mitigation of radon in the air by active soil depressurization is most effective. Concrete slabs, sub-floors, and/or crawlspaces are sealed, an air pathway is then created to exhaust radon above the roof-line, and a radon mitigation fan is installed to run permanently. In particularly troublesome dwellings, air exchangers can be used to reduce indoor radon concentrations. Treatment systems using aeration or activated charcoal are available to remove radon from domestic water supplies. There is no proven link between radon in water and gastrointestinal cancers; however, extremely high radon concentrations in water can be aerosolized by faucets and shower heads and contribute to high indoor radon levels in the air.

Testing

[edit]

A typical radon test kit

Fluctuation of ambient air radon concentration over one week, measured in a laboratory

The first step in mitigation is testing. No level of radiation is considered completely safe, but as it cannot be eliminated, governments around the world have set various *action levels* to provide guidance on when radon concentrations should be reduced. The World Health Organization's International Radon Project has recommended an action level of 100 Bq/m^3 (2.7 pCi/L) for radon in the air.[2] Radon in the air is considered to be a larger health threat than radon in domestic water. The US Environmental Protection Agency recommendation is to not test for radon in water unless a radon in air test shows concentrations above the action level. However, in some U.S. states such as Maine where radon levels are higher than the national average, it is recommend that all well water should be tested for radon. The U.S. government has not set an action level for radon in water.

Air-radon levels fluctuate naturally on a daily and seasonal basis. A short term test (90 days or less) might not be an accurate assessment of a home's average radon level, but is recommended for initial testing to quickly determine unhealthy conditions. Transient weather such as wind and changes in barometric pressure can affect short-term concentrations as well as ventilation, such as open windows and the operation of exhaust fans.

Testing for radon in the air is accomplished using passive or active devices placed in the building. Some devices are promptly sent to a laboratory for analysis, others calculate the results on-site including digital Radon detectors. Radon-in-water testing requires a water sample being sent to a laboratory.

Retesting is recommended in several situations, for example, before spending money on the installation of a mitigation system. Test results which exceed accuracy tolerances also require re-testing. When a mitigation system installation is warranted, a retest after the system is functional is advised to be sure the system is effectively reducing the radon concentration below the action level, and after any mitigation system repairs such as replacing a fan unit. The US EPA recommends retesting homes with radon problems every two years to ensure proper system function. Due to the vast fluctuation in indoor radon levels, the EPA recommends all homes be tested at least once every five years.[3]

Testing in the United States

[edit]

Radon map of the United States

ASTM E-2121 is a US standard for reducing airborne radon in homes as far as practicable below the action level of 4 picocuries per liter (pCi/L) (148 Bq/m^3).[4][5] Some states recommend achieving 2.0 pCi/L or less.

Radon test kits are commercially available[6] and can be used by homeowners and tenants and in limited cases by landlords, except when a property is for sale.

Commercially available test kits include a passive collector that the user places in the lowest livable floor of the house for 2 to 7 days. The user then sends the collector to a laboratory for analysis. Long-term kits, taking collections from 91 days to one year, are also available. Open land test kits can test radon emissions from the land before construction begins, but are not recommended by the EPA because they do not accurately predict the final indoor radon level. The EPA and the National Environmental Health Association have identified 15 types of radon test devices.[7] A Lucas cell is one type of device.

Retesting is specifically recommended in several situations. Measurements between 4 and 10 pCi/L (148 and 370 Bq/m^3) warrant a follow-up short-term or long-term radon test before mitigation. Measurements over 10 pCi/L (370 Bq/m^3) warrant only another short-term test (not a long-term test) so that abatement measures are not unduly delayed.

Progress has been made regarding radon in the home. A total of 37 states have now[*when?*] passed legislation requiring home-sellers to disclose known radon levels before completing the transaction (although only a handful have introduced criminal penalties for misrepresentation).[8] And over half the legislatures have written radon into their state's building code.[9] Purchasers of real estate may delay or decline a purchase if the seller has not successfully abated radon to less than 4 pCi/L.

The accuracy of the residential radon test depends upon whether closed house conditions are maintained. Thus the occupants will be instructed not to open windows, etc., for ventilation during the pendency of test, usually two days or more. However, the occupants, if the present owners, will be motivated to pass the test and insure the sale, so they might be tempted to open a window to get a lower radon score. Moreover, there may be children or immature teens or young adults in the house who will open a window for ventilation notwithstanding instructions not to do so, particularly in uncomfortably hot weather. Accordingly, whether the potential purchaser should trust the result of such a test is problematic.

Management of radon service provider certification has evolved since being introduced by the EPA in 1986. In the 1990s this service was "privatized" and the National Environmental Health Association (NEHA) helped transition the voluntary National Radon Proficiency Program (NRPP) to be administered by private firms. As of 2012, the NRPP is administered by the American Association of Radon Scientists and Technologists (AARST).[10]

Some states, such as Maine, require landlords to test their rental properties and turn the results in to the state. In limited cases the landlord or tenants may do the testing themselves. The rules in each state vary. In many cases there are private contractors that will inspect hired by the city.

Testing in Canada

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Health Canada recommends regular annual testing, either by hiring a qualified tester or by using a home-testing kit that should be checked quarterly.[11]

Canadian Government, in conjunction with the territories and provinces, developed the guideline[12] to indicate when remedial action should be taken was originally set at 800 Bq/m^3 (becquerels per cubic meter) and since reduced to 200 Bq/m^3. This new guideline was approved by the Federal Provincial Territorial Radiation Protection Committee in October 2006.[13]

Testing in the UK

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Radon testing in the UK is managed by UKradon and the UKHSA.[14]

Testing in Norway

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The Norwegian Radiation and Nuclear Safety Authority (DSA) developed the protocol[15] for radon measurements in residential dwellings[16] with respect to rental accommodation, which is governed by The Radiation Protection Regulations.[17]

Methods of radon gas mitigation

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Part of a radon mitigation system including the fan and vent pipe is visible near the gutter downspout.

Because high levels of radon have been found in every state of the United States,[18] testing for radon and installing radon mitigation systems has become a specialized industry since the 1980s. Many states have implemented programs that affect home buying and awareness in the real estate community; however, radon testing and mitigation systems are not generally mandatory unless specified by the local jurisdiction.[19]

Anticipated high radon levels can be mitigated during building design and construction by a combination of ensuring a perfectly sealed foundation, allowing sufficient passive dispersal of under-slab gas around rather than through the building, and proper building ventilation. In many instances, such approaches may achieve a sufficient reduction of radon levels compared to other buildings where such approaches were not taken. However, quality of implementation is crucial and testing after construction is necessary. For instance, even a small gap in the sealing of the slab may be sufficient for excessive quantities of radon to enter, given pressure differentials.

Where such approaches were not taken during construction or have proven insufficiently effective, remediation is needed. According to the EPA's "A Citizen's Guide to Radon",[20] the method to reduce radon "primarily used is a vent pipe system and fan, which pulls radon from beneath the house and vents it to the outside", which is also called sub-slab depressurization, soil suction, or active soil depressurization (ASD). Generally indoor radon can be mitigated by sub-slab depressurization and exhausting such radon-laden air to the outdoors, away from windows and other building openings.[21] "EPA generally recommends methods which prevent the entry of radon. Soil suction, for example, prevents radon from entering your home by drawing the radon from below the home and venting it through a pipe, or pipes, to the air above the home where it is quickly diluted" and "EPA does not recommend the use of sealing alone to reduce radon because, by itself, sealing has not been shown to lower radon levels significantly or consistently" according to the EPA's "Consumer's Guide to Radon Reduction: How to Fix Your Home".[22] Ventilation systems can utilize a heat exchanger or energy recovery ventilator to recover part of the energy otherwise lost in the process of exchanging air with the outside. For crawlspaces, the EPA states,[22] "An effective method to reduce radon levels in crawlspace homes involves covering the earth floor with a high-density plastic sheet. A vent pipe and fan are used to draw the radon from under the sheet and vent it to the outdoors. This form of soil suction is called submembrane suction, and when properly applied is the most effective way to reduce radon levels in crawlspace homes."

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High radon levels in a Minnesota (USA) basement with a passive under slab vent pipe system can be seen in the left half of the graph. After installation of a radon fan (ASD), a permanent reduction in radon levels to approximately 0.6 pCi/L can be seen in the right half of the graph.

- The most common approach is active soil depressurization (ASD). Experience has shown that ASD is applicable to most buildings since radon usually enters from the soil and rock underneath and mechanical ventilation is used when the indoor radon is emitted from the building materials. A less common approach works efficiently by reducing air pressures within cavities of exterior and demising walls where radon emitting from building materials, most often concrete blocks, collects.
- Above slab air pressure differential barrier technology (ASAPDB) requires that the interior pressure envelope, most often drywall, as well as all ductwork for air conditioning systems, be made as airtight as possible. A small blower, often no more than 15 cubic feet per minute (0.7 L/s) may then extract the radon-laden air from these cavities and exhaust it to the out of doors. With well-sealed HVAC ducts, very small negative pressures, perhaps as little as 0.5 pascal (0.00007 psi), will prevent the entry of highly radon-laden wall cavity air from entering into the breathing zone. Such ASAPDB technology is often the best radon mitigation choice for high-rise condominiums as it does not increase indoor humidity loads in hot humid climates, and it can also work well to prevent mold growth in exterior walls in heating climates.
- In hot, humid climates, heat recovery ventilators (HRV) as well as energy recovery ventilators (ERV) have a record of increasing indoor relative humidity and dehumidification demands on air conditioning systems. Mold problems can occur in homes that have been radon mitigated with HRV and ERV installations in hot, humid climates.[*citation needed*] HRVs and ERVs have an excellent record in cold dry climates.
- A recent technology is based on building science. It includes a variable rate mechanical ventilation system that prevents indoor relative humidity from rising above a preset level such as 50% which is currently suggested by the US Environmental Protection Agency and others as an upper limit for the prevention of mold. It has proven to be especially effective in hot, humid climates. It controls the air delivery rate so that the air conditioner is never overloaded with more moisture than it can effectively remove from the indoor air.
    - It is generally assumed that air conditioner operation will remove excess moisture from the air in the breathing zone, but it is important to note that just because the air conditioner cools does not mean that it is also dehumidfying. If ?*t* is 14 degrees or

less, it may not dehumidify at all even though it is cooling.
  - Factors that are likely to aggravate indoor humidity problems from mechanical ventilation–based radon installations are as follows and an expert radon mitigator/building scientist will check for and correct any and all of the following when he or she performs radon mitigation procedures:
    - Air conditioner duct leaks located outside the breathing zone, such as in the attic.
    - Excessive exhaust fan operation
    - Oversize or over-capacity air conditioners
    - AC air handler fans that do not stop running when the air conditioner compressor stops running.
    - Delta *t* (?*t*), which is the amount that the air is cooled as it is passed through the air conditioner's cooling coils. A good ?*t* performance figure for home air conditioners is about 20 °F (11 °C). In comparison, automobile air conditioners deliver ?*t* performance of 32 to 38 °F (18 to 21 °C). A ?*t* of 14 °F (8 °C) will dehumidify poorly if at all.

In South Florida, most radon mitigation is performed by use of fixed rate mechanical ventilation. Radon mitigation training in Florida does not include problems associated with mechanical ventilation systems, such as high indoor humidity, mold, moldy odors, property damage or health consequences of human occupation in high humidity of moldy environments[*citation needed*]. As a result, most Florida radon mitigators are unaware of and do not incorporate existing building science moisture management technology into mechanical ventilation radon installations. Home inspectors may not necessarily be aware of the mold risks associated with radon mitigation by mechanical ventilation.

The average cost for an ASD radon mitigation system in Minnesota is $1500.[23] These costs are very dependent on the type of home and age of construction.[24]

Methods of radon-in-water mitigation

[edit]

Radon removal from water supplies may be at a treatment plant, point of entry, or point of use. Public water supplies in the United States were required to treat for radionuclides beginning in 2003 but private wells are not regulated by the federal government as of 2014. The radon can be captured by granular activated charcoal (GAR) or released into the air through aeration of the water. Radon will naturally dissipate from water over a period of days, but the quantity of storage needed to treat the water in this manner makes home systems of this type impracticably large.[25]

Activated carbon systems capture radon from the water. The amount of radiation accumulates over time and the filter material may reach the level of requiring disposal as a radioactive waste. However, in the United States there are no regulations concerning radiation levels and disposal of radon treatment waste as of 2014.

Aeration systems move the radon from the water to the air. Radon gas discharged into the air is the release of a pollutant, and may become regulated in the United States.

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[edit]

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External links

[edit]

- Radon at the United States Environmental Protection Agency
- National Radon Program Services hosted by Kansas State University
- Radon and Lung Health from the American Lung Association
- It's Your Health - Health Canada
- Radon's impact on your health – Quebec Lung Association

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Radiation protection

Main articles	Background radiation Dosimetry Health physics Ionizing radiation Internal dosimetry Radioactive contamination Radioactive sources Radiobiology
Measurement quantities and units	Absorbed dose Becquerel Committed dose Computed tomography dose index Counts per minute Effective dose Equivalent dose Gray Mean glandular dose Monitor unit Rad Roentgen Rem Sievert

Instruments and measurement techniques	Airborne radioactive particulate monitoring Dosimeter Geiger counter Ion chamber Scintillation counter Proportional counter Radiation monitoring Semiconductor detector Survey meter Whole-body counting
Protection techniques	Lead shielding Glovebox Potassium iodide Radon mitigation Respirators
Organisations	Euratom HPS (USA) IAEA ICRU ICRP IRPA SRP (UK) UNSCEAR
Regulation	IRR (UK) NRC (USA) ONR (UK) Radiation Protection Convention, 1960
Radiation effects	Acute radiation syndrome Radiation-induced cancer

See also the categories Medical physics, Radiation effects, Radioactivity, Radiobiology, and Radiation protection

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Heating, ventilation, and air conditioning

Fundamental concepts

- Air changes per hour (ACH)
- Bake-out
- Building envelope
- Convection
- Dilution
- Domestic energy consumption
- Enthalpy
- Fluid dynamics
- Gas compressor
- Heat pump and refrigeration cycle
- Heat transfer
- Humidity
- Infiltration
- Latent heat
- Noise control
- Outgassing
- Particulates
- Psychrometrics
- Sensible heat
- Stack effect
- Thermal comfort
- Thermal destratification
- Thermal mass
- Thermodynamics
- Vapour pressure of water

Technology

- Absorption-compression heat pump
- Absorption refrigerator
- Air barrier
- Air conditioning
- Antifreeze
- Automobile air conditioning
- Autonomous building
- Building insulation materials
- Central heating
- Central solar heating
- Chilled beam
- Chilled water
- Constant air volume (CAV)
- Coolant
- Cross ventilation
- Dedicated outdoor air system (DOAS)
- Deep water source cooling
- Demand controlled ventilation (DCV)
- Displacement ventilation
- District cooling
- District heating
- Electric heating
- Energy recovery ventilation (ERV)
- Firestop
- Forced-air
- Forced-air gas
- Free cooling
- Heat recovery ventilation (HRV)
- Hybrid heat
- Hydronics
- Ice storage air conditioning
- Kitchen ventilation
- Mixed-mode ventilation
- Microgeneration
- Passive cooling
- Passive daytime radiative cooling
- Passive house
- Passive ventilation
- Radiant heating and cooling
- Radiant cooling
- Radiant heating
- Radon mitigation
- Refrigeration
- Renewable heat
- Room air distribution
- Solar air heat
- Solar combisystem
- Solar cooling

- Air conditioner inverter
- Air door
- Air filter
- Air handler
- Air ionizer
- Air-mixing plenum
- Air purifier
- Air source heat pump
- Attic fan
- Automatic balancing valve
- Back boiler
- Barrier pipe
- Blast damper
- Boiler
- Centrifugal fan
- Ceramic heater
- Chiller
- Condensate pump
- Condenser
- Condensing boiler
- Convection heater
- Compressor
- Cooling tower
- Damper
- Dehumidifier
- Duct
- Economizer
- Electrostatic precipitator
- Evaporative cooler
- Evaporator
- Exhaust hood
- Expansion tank
- Fan
- Fan coil unit
- Fan filter unit
- Fan heater
- Fire damper
- Fireplace
- Fireplace insert
- Freeze stat
- Flue
- Freon
- Fume hood
- Furnace
- Gas compressor
- Gas heater
- Gasoline heater
- Grease duct

Measurement and control

- Air flow meter
- Aquastat
- BACnet
- Blower door
- Building automation
- Carbon dioxide sensor
- Clean air delivery rate (CADR)
- Control valve
- Gas detector
- Home energy monitor
- Humidistat
- HVAC control system
- Infrared thermometer
- Intelligent buildings
- LonWorks
- Minimum efficiency reporting value (MERV)
- Normal temperature and pressure (NTP)
- OpenTherm
- Programmable communicating thermostat
- Programmable thermostat
- Psychrometrics
- Room temperature
- Smart thermostat
- Standard temperature and pressure (STP)
- Thermographic camera
- Thermostat
- Thermostatic radiator valve

Professions, trades, and services	○ Architectural acoustics ○ Architectural engineering ○ Architectural technologist ○ Building services engineering ○ Building information modeling (BIM) ○ Deep energy retrofit ○ Duct cleaning ○ Duct leakage testing ○ Environmental engineering ○ Hydronic balancing ○ Kitchen exhaust cleaning ○ Mechanical engineering ○ Mechanical, electrical, and plumbing ○ Mold growth, assessment, and remediation ○ Refrigerant reclamation ○ Testing, adjusting, balancing
Industry organizations	○ AHRI ○ AMCA ○ ASHRAE ○ ASTM International ○ BRE ○ BSRIA ○ CIBSE ○ Institute of Refrigeration ○ IIR ○ LEED ○ SMACNA ○ UMC
Health and safety	○ Indoor air quality (IAQ) ○ Passive smoking ○ Sick building syndrome (SBS) ○ Volatile organic compound (VOC)

See also	○ ASHRAE Handbook ○ Building science ○ Fireproofing ○ Glossary of HVAC terms ○ Warm Spaces ○ World Refrigeration Day ○ Template:Fire protection ○ Template:Home automation ○ Template:Solar energy

About Cook County

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Things To Do in Cook County

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Sand Ridge Nature Center

4.8 (96)

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River Trail Nature Center

4.6 (235)

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Palmisano (Henry) Park

4.7 (1262)

Driving Directions in Cook County

Driving Directions From Palmisano (Henry) Park to

Driving Directions From Lake Katherine Nature Center and Botanic Gardens to

Driving Directions From Navy Pier to

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Reviews for

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Jeffery James

(5)

Very happy with my experience. They were prompt and followed through, and very helpful in fixing the crack in my foundation.

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Sarah McNeily

(5)

USS was excellent. They are honest, straightforward, trustworthy, and conscientious. They thoughtfully removed the flowers and flower bulbs to dig where they needed in the yard, replanted said flowers and spread the extra dirt to fill in an area of the yard. We've had other services from different companies and our yard was really a mess after. They kept the job site meticulously clean. The crew was on time and friendly. I'd recommend them any day!

Thanks to Jessie and crew.

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Jim de Leon

(5)

It was a pleasure to work with Rick and his crew. From the beginning, Rick listened to my concerns and what I wished to accomplish. Out of the 6 contractors that quoted the project, Rick seemed the MOST willing to accommodate my wishes. His pricing was definitely more than fair as well. I had 10 push piers installed to stabilize and lift an addition of my house. The project commenced at the date that Rick had disclosed initially and it was completed within the same time period expected (based on Rick's original assessment). The crew was well informed, courteous, and hard working. They were not loud (even while equipment was being utilized) and were well spoken. My neighbors were very impressed on how polite they were when they entered / exited my property (saying hello or good morning each day when they crossed paths). You can tell they care about the customer concerns. They ensured that the property would be put back as clean as possible by placing MANY sheets of plywood down prior to excavating. They compacted the dirt back in the holes extremely well to avoid large stock piles of soils. All the while, the main office was calling me to discuss updates and expectations of completion. They provided waivers of lien, certificates of insurance, properly acquired permits, and JULIE locates. From a construction background, I can tell you that I did not see any flaws in the way they operated and this an extremely professional company. The pictures attached show the push piers added to the foundation (pictures 1, 2 & 3), the amount of excavation (picture 4), and the restoration after dirt was placed back in the pits and compacted (pictures 5, 6 & 7). Please notice that they also sealed two large cracks and steel plated these cracks from expanding further (which you can see under my sliding glass door). I, as well as my wife, are extremely happy that we chose United Structural Systems for our contractor. I would happily tell any of my friends and family to use this contractor should the opportunity arise!

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Chris Abplanalp

(5)

USS did an amazing job on my underpinning on my house, they were also very courteous to the proximity of my property line next to my neighbor. They kept things in order with all the dirt/mud they had to excavate. They were done exactly in the timeframe they indicated, and the contract was very details oriented with drawings of what would be done. Only thing that would have been nice, is they left my concrete a little muddy with boot prints but again, all-in-all a great job

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Dave Kari

(5)

What a fantastic experience! Owner Rick Thomas is a trustworthy professional. Nick and the crew are hard working, knowledgeable and experienced. I interviewed every company in the area, big and small. A homeowner never wants to hear that they have foundation issues. Out of every company, I trusted USS the most, and it paid off in the end. Highly recommend.

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