

ACTION PLAN: OUTDOOR POLLUTION



You can't completely stop outside air from getting in, so minimize the intrusion of outdoor sources of pollution and instead fill the house with fresh air to make the living spaces of your home healthier.

QUICKSTART GUIDE: OUTDOOR POLLUTION

Most people are aware of the risks posed by outdoor pollution. But did you know that outdoor pollutants can become 5-10x more concentrated indoors? It is important to know what is in your outdoor air and how to keep it out of your home. Typically people are shocked when they learn what is in their indoor air! There are a few ways to determine if outdoor pollutants are getting inside your home.

The simplest is to gauge your reaction – do you smell an odor? Do you see a lot of grey or dark dust collecting on windowsills? Do you get congested or develop a headache or sore throat at certain times of the day or when certain events happen outdoors? You can also use an indoor air quality monitor to measure levels of certain particulates and VOCs (volatile organic compounds).

Acting effectively to prevent infiltration means being able to identify the sources of pollution and to understand how susceptible your house is before you can make decisions about air tightening and adding ventilation. Completion of all steps, in the order listed below, will provide maximum benefit.

1. Identify the local and distant sources of potential outdoor pollution which are likely to migrate towards the house
2. Evaluate the house to determine the potential for infiltration into the house
3. Air seal (tighten) the house using non-toxic materials.
4. Add mechanical ventilation with filtration

IMPLEMENTATION MANUAL

OVERVIEW

By reducing the infiltration of outside pollution through the building envelope into the living space, you can improve the air quality inside your home and increase your Hayward Score. In addition, these actions will reduce the migration of stagnant air through walls, ceilings, and floors into the breathing zone.

This manual is designed to help you address the issues for air tightening and properly ventilating your house. Although most of these actions and their combinations are not new, the reasons for doing them may be new to you or to your contractor. Most professionals have been trained to comply with local building codes and general industry standards. Our practices exceed these standards in order to address the impact of the house on occupants' health and well-being.

Our methodology encompasses building science and academic research in combination with practical experience. It usually exceeds most industry standards and dramatically reduces pollutants in the outdoor air from entering your living spaces. It is critically important that the steps be completed as specified and in the order listed!

STEP 1: DETERMINE SOURCES OF POTENTIAL OUTDOOR POLLUTION

STEP 2: EVALUATE THE HOUSE

STEP 3: AIR SEAL BETWEEN OUTSIDE AND THE LIVING SPACE

STEP 4: ADD MECHANICAL VENTILATION WITH FILTRATION

STEP 5: VERIFY SUCCESS

STEP 1: DETERMINE POTENTIAL OUTDOOR SOURCES OF POLLUTION

Chances are you haven't deliberately surveyed your neighborhood for outside sources of pollution. So before you assume that whatever is outside stays outside, find out what might be able to come toward your house and get inside.

The sheer number of outdoor pollution sources surprises many people. It is most important to focus on sources adjacent to your home (like an attached garage or combustion vents), those 400-500 feet away, and those 1/2 mile away.

“Local” pollution sources can usually be identified visually but their impactfulness can be determined by your sense of smell at your house. The more you can smell the coffee, food, the unique odor of dry cleaning, or the distinctive smell of gas stations and repair garages, etc, the more impactful they can be. Even golf courses have their own identifying aroma because of frequent applications of pesticides and fertilizers. “Distant” pollution sources are more easily identified visually rather than by smell.

They are potential sources because they may not actually get to the vicinity of your house. It is important to note the direction of the prevailing wind and whether the sources are upwind or downwind from your house. This applies to all sources whether close or further away and regardless of what it is composed of. Identify, as best you can, which (if any) of the sources are getting inside the house, because these outside substances should not be inside your house.

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Walk the perimeter of your house and take a lap inside your garage. Look for sources like:

- Combustion vents
- Pesticides and chemicals that are stored in spaces that are adjacent to the house (for example, in an attached garage)
- Fuel oil storage
- Where pesticides and fungicides are applied

Go outside and walk around the house looking for pollution sources that are within a block (400-500 feet) of your house and look for sources like:

- Coffee Roaster
- Dry Cleaner
- Gas Station or automotive repair facility
- Golf course
- Restaurant
- Construction site
- Neighbors (cooking, bbq-ing, applying pesticides or fertilizer, smoking)

Go outside the house and walk, drive, or look at Google Earth to identify any potential pollution sources within $\frac{1}{2}$ mile of your house. For example:

- Agricultural area or farm
- Airport
- Highway
- Industrial area or chemical plant
- Lakes, wetlands, or rivers
- Ocean
- Sewage treatment plants
- Waste dumps

Note the prevailing wind direction and which of the above are upwind of the house. Upwind outdoor pollution will be the main outside sources of concern. Those downwind can sometimes be ignored, depending on your personal sensitivities and frequency of the pollution.

STEP 5: REMOVAL OF VISIBLE MOLD

An air tight house won't let much outside air or moisture get inside, but a leaky house will. Tight houses will block most outdoor pollution even when in close proximity to sources. Less tight houses will allow more penetration from outside to inside more frequently and at comparatively higher levels of accumulation. The majority of houses are quite leaky, as measured by air changes per hour (ACH). Few are less than about 10 ACH. Houses built since 2005 by code should be between 3-5 ACH. The tightest are Passive Houses, which must meet a measured standard of 0.6 ACH. At 5 ACH or lower, balanced ventilation is absolutely required to have healthy indoor air, but is most often not installed.

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Consider a full energy audit. Local utility companies often offer this service, which includes a measurement of air leakage as well as a detailed evaluation of the house for air pathways through the building envelope. Their tools will usually include identifying the major sources of leaks. This information can greatly improve your chances of successfully blocking the outside pollution from coming inside your house.

A quicker and less expensive evaluation is to go outside and look at your house. Note the vents and other openings into the house, especially those associated with the roof, attic, basement, or crawlspace. Unless you install a mechanical ventilation system to replace passive ventilation (vents, crawlspace), you cannot block these main entry points, and thus outdoor air, because they are essential for the proper functioning of the house. That said, be aware of their existence because that information may be invaluable later.

NOTE: Feel a draft? That is a sure sign that outdoor air is getting inside!

Go outside the house to look for vents and other openings into the house, especially those associated with the roof, attic, basement, and/or crawlspace.

These primary entry points for outside air can't be blocked because they are important for the proper functioning of the house, but it is important to know where they are.

Inspect the house close-up (indoors and outdoors), looking for air and moisture pathways that aren't properly sealed. In particular look for:

Cracked or loose caulk around windows and doors

Missing weather stripping around doors to the outside, windows, and into the garage, Make sure to check the door that connects the house to the garage as well as the actual garage door.

Unsealed openings where electrical, water, cable and plumbing enter the house

Identify, as best you can, which (if any) of the outside pollution is getting inside the house.

In this case your nose “knows.” If you can smell it, it is getting in. Other clues are dark dust on windowsills, which is often brake dust if you live close to a highway or major thoroughfare, or a draft!

STEP 3: AIR SEAL / TIGHTEN THE HOUSE

In order to effectively block the movement of outdoor pollution into your house, you need to seal air pathways between outside and the living space.

At a minimum, fix any loose, cracked, or missing caulking and weather stripping and ensure that entry points for electric, gas, water, and plumbing are properly sealed.

The critical action for not replacing one problem with a new one is to carefully evaluate the caulk, foam, tape, and other materials you use to air seal.

Some are solvent-based, which means you are attempting to block outside pollutants with materials that can off-gas potentially toxic chemicals and VOCs installed directly inside your home!

Also, take action recommended by energy saving programs. The reasons for heat loss can also be the reasons for air pathways, allowing outside pollution to enter the house.

MATERIAL LIST:

Non-toxic caulk or tape

Non-toxic expanding foam

STEP 4: ADD MECHANICAL VENTILATION WITH FILTRATION

A house needs to be sufficiently air tight to keep the outside air and pollutants out. But an air tight house also means that inside sources of pollution stay inside and accumulate. According to the EPA and other sources, pollutants that come indoors can accumulate to as much as 5-10x the levels they would be outdoors. This means there needs to be a balance between too much air leakage and sufficient ventilation. You want to stop sucking in bad air and fill your house with fresh air.

The solution is to install balanced mechanical ventilation with filtration in the form of a HRV (heat recovery ventilator) or, depending on climate, an ERV (energy recovery ventilator). These systems provide a continuous flow of filtered outside air into, through, and back out of the house to the outside air. This solves the accumulation problem of indoor generated pollution. But if the outside air is polluted from sources within the two distance ranges noted above, then filtration may be needed.

The HRV/ERV will need filters. Particle filters of at least MERV 13 (HEPA is better) for dust and other particles. They will also need charcoal combinations to reduce the odors, chemicals, and other molecular pollutants. More advanced filters may be needed for specific odors.

Bath fans appropriately installed with make-up air, used when needed, and with effective filters can sometimes be used in place of ERV/HRVs.

An effective HRV/ERV system requires professional guidance and installation to make sure the unit is properly sized and correctly installed. ERV/HRV systems are energy efficient, extremely quiet, and can help minimize allergic reactions at home.

STEP 5: VERIFY SUCCESS

There are two ways to verify success. The first is to have a professional energy audit to measure the ACH. If your house has been properly sealed, your ACH should be lower.

The second is based on your personal experience. If you could previously smell the odors from specific sources, but can't now, then that part has been successful. If you previously had noticeable reactions which are now gone, then you know those sources have been blocked.

If these fail, and if your reactivity or preventive concerns are sufficient to justify the cost, professional lab testing can be conducted to determine if there are detectable pollutants inside that can only come from outside. In which case, further evaluation of proximate sources, wind patterns, and infiltration openings will be needed, followed by additional steps to remedy. If stopping the sources of exposure are unsuccessful, and if the personal decision to stop exposure is necessary, then the only recourse is remove yourself from the sources by moving to another house in a location with less outdoor sources of pollution.

MAINTENANCE MANUAL

GOAL: KEEP OUTDOOR POLLUTION OUT OF YOUR LIVING SPACES.

Getting outdoor pollution out of your indoor air is a start, but you have to maintain what you have done and that means periodically checking out your house and keeping air seals in good repair. We suggest doing the following once or twice a year:

Check for any changes in outdoor sources of pollution both adjacent to and up to 1/2 mile from the house.

- Have new restaurants or gas stations opened? Has anything closed?
- Is spraying being done on a different schedule at a nearby golf course or agricultural area? Have you applied any chemicals or pesticides on your own property?
- Do you notice more or different types of dust?
- Do you notice new or different odors in the house?
- Has new construction started nearby?

- Is there a new or different car parked in your garage?

Maintenance Action: Depends on what has changed. If new sources are in locations that impact your home, you may need to revisit the Action Plan. This involves tracking the source of the odor, identifying how it is getting in the house, and blocking that pathway.

Inspect vents and other openings into the house, especially those associated with either the roof, attic, basement, or crawlspace. These will be main entry points for air and moisture but cannot be blocked because they are part of the proper functioning of the house, but you want to make sure that they are not blocked and are in good repair.

Maintenance Action: If any are blocked, remove the blockage. If dampers are in place, check for proper functioning. If they neither open nor close when they should, correct the functioning or replace the part.

Watch out for excessive heat loss. If you think this is occurring, check closely for the air pathways or for thermal bridges. The air pathways that are the reasons for heat loss can also be how outside pollution enters the house.

MAINTENANCE ACTION: Optimally, conduct an energy audit for a formal, detailed evaluation of the house for energy loss and locations of air pathways through the building envelope. Comply with the recommendations.

Inspect the house close-up (both indoors and outdoors), looking for cracked or loose caulk around windows and doors, missing weather stripping around doors, unsealed openings where electrical, water, cable and plumbing enter the house. Air and moisture pathways can also be openings for insects and some rodents.

MAINTENANCE ACTION: Keep all seals in good repair. If caulking or weather stripping is cracked, loose, or missing replace with appropriate material. If the cause appears to be from insect or rodent activity, investigate further so appropriate action can be taken to repair the remove the pests, determine what happened and how to remediate. and remove the pest from inside the house. what happened and how to remediate.

Verify correct functioning of the ERV/HRV and that the filters have been replaced on schedule.

MAINTENANCE ACTION: Filter replacement is often DIY. All else requires a professional.

CHECKLIST

It is critical to execute each step in the order listed. Detailed instructions are in the Hayward Score Outdoor Pollution Implementation Manual.



STEP 1: IDENTIFY LOCAL AND DISTANT SOURCES

Walk the perimeter of your house and look for combustion vents, where pesticides get applied, where chemicals are stored and even bbq grills. While you are walking, look for the same things in your neighbors' yards as they'll often migrate to your house.



Go outside and walk around the house looking for pollution sources that are within a block (400-500 feet) of your house.



Go outside the house and walk, drive, or look at Google Earth to identify any potential pollution sources within $\frac{1}{2}$ mile of your house.

STEP 2:

EVALUATE THE HOUSE

Before you can decide how best to block pollutants from getting in the house, you need to know how they are getting in. Consider having a full energy audit done usually by your local utility company or a BPI certified home performance professional. The same pathways that allow heat to escape also allow outdoor pollution, odors, and pests to enter.



Outside the house, look for vents and other openings into the house, especially those associated with the roof, attic, basement, and/or crawlspace. You won't be able to block these as they are critical functions of the balanced systems of the house. If mechanical ventilation is installed these are usually addressed. It is therefore important to know what they are and where they are located.



Get out a flashlight and inspect the house close-up, looking for cracked or loose caulk around windows and doors, missing weather stripping around windows and doors, and unsealed openings where electrical, water, and plumbing enter the house.



Identify, as best you can, which (if any) of the outside pollution is getting inside the house.

In this case your nose “knows.” If you can smell it, It is getting in. Also if you are having a reaction like congestion, sore throat or headache, that may be an indicator - especially for those that don’t have odor. Other clues are dark dust on windowsills, which is often brake dust if you live close to a highway or major thoroughfare.



STEP 3: AIR SEAL/TIGHTEN THE HOUSE

Tight houses will block most outdoor pollution even when in close proximity and with frequent migration. Less tight houses will allow more penetration from outside to inside more frequently and at comparatively higher levels of accumulation.

At a minimum, fix any loose, cracked, or missing caulking and weather stripping and ensure that entry points for electric, gas, water, and plumbing are properly sealed

TIP:

Research has shown that 96% of shoes have fecal matter on their soles. ICK. A quick way to stop outdoor pollutants from getting inside your house is to take your shoes off at the door!

STEP 4: ADD BALANCED MECHANICAL VENTILATION WITH FILTRATION

Tighter houses must have some form of mechanical ventilation with filtration, which ensures that fresh air is continuously circulating and pollutants are drawn out.



We recommend installing a high performance, quiet, energy efficient ERV/HRV for fresh outside air that can be fitted with filtration for the dust and odors you've identified.



If an HRV or ERV is used then the airflow must be designed and installed according to manufacturer's specifications.

STEP 5: VERIFY SUCCESS

Using the same criteria from above for determining that outside pollution was detected inside the house - whether through measurement, odor, or specific reactions - determine that those sources have been sufficiently reduced.



If you are still reacting to pollution in the house, there are two options: Conduct another assessment to identify where the airflow entry points and circulation patterns continue to exist. If the house remains intolerable or uninhabitable after several attempts to keep outdoor pollution outdoors, then the only option is to remove yourself from the exposures by moving to a house that is away from the sources of pollution that trigger reactions.

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