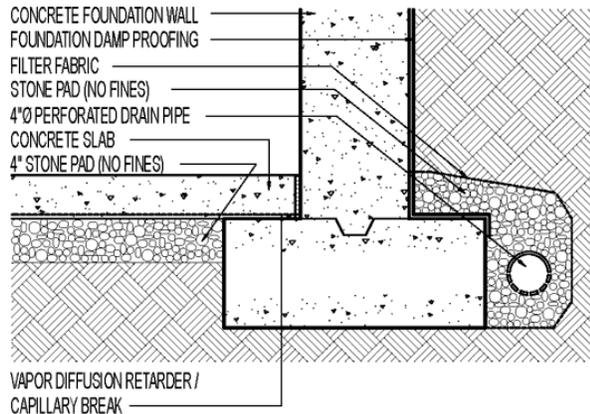
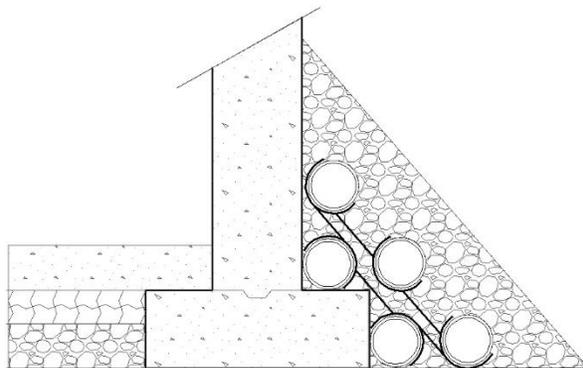


GEM Gas Exhaust Mitigation



Houses that use natural gas produce CO₂ and lots of it. Here is a drawing of a typical setup in today's most common basement building style. This is referred to as weeping pipe. The cost of having this installed on a new home is around \$50 a linear meter. The pipe we all use is cheap and made from 100% recycled plastic. This has been a common practice for decades. This pipe runs around the perimeter of the building and drains through the footing and connects at a sump pump. Rainwater works its way down and into this pipe and then into the sump basin.

Most gas appliances like fireplaces, hot water heating devices and furnaces are direct vented now. The exhaust from these devices directly vents outside through the joist-space and into the atmosphere.



99% of the time weeping pipe is doing little to nothing, even one working and handling water would never have more than a few millimeters of water in it. Given the setup we already have in place here, it's not unreasonable to consider venting our CO₂ producing appliances into these pipes and the surrounding gravel. We've designed a method to allow us to run 5 weeping pipes in the gravel from the exhaust site to the water main shutoff stem allowing us to vent gas exhaust throughout this system.

An average vehicle produces 5 tonnes of CO₂ annually, most stand-alone homes produce two times that. Not all homes in Canada use natural gas, but for those that do, the average use is 88.4 gigajoules (GJ) per year. According to the Engineering toolbox, every burned gigajoule of natural gas produces 50 Kg of CO₂. $88.4 \times 50 = 4420$ kgs of CO₂. Incomplete burning releases methane into the atmosphere that is now considered to be 84-120 times worse for the environment than CO₂ over 20 years.

According to ATCO, the average Alberta home uses 120 gigajoules of natural gas per year. This translates into 6 tonnes of CO₂ and 12 tonnes of CO₂e depending on what the home runs for appliances.

Canada builds 50000 new stand-alone single-family homes every year. Assuming 90% of them were to use natural gas this would equate to 400 kilotonnes of CO₂e added annually. Over 10 years, this would represent 22 megatonnes. We propose to significantly reduce this through GEM and further reduce it through Rhea Building Logic. From a GEM perspective, the market is at a minimum of 45000 houses annually and perhaps a retrofit market too. Once we demonstrate and determine the effectiveness of GEM, we could see it being mandated into use, allowing us to capture near 100% of the direct vent market. The value proposition from natural gas remains the same and is why it is so popular. Now that the CO₂e is mitigated and the stigma from burning this fossil fuel is alleviated we can move forward knowing that the gas component of our homes is near-zero-emissions. As one of the bonuses to doing this, we also mitigate the radon gas in the building zone. The unburned methane component is one of the smallest amounts and one of the lightest components and is the easiest to capture. Just capturing this component can cut the CO₂e in half. Trees get all the credit for taking CO₂ out of the air but they are not the only engine that does the work, soil does it too. Methane is also one of the building blocks, through our patentable process bacteria in the soil can take CH₄ and convert it into NH₄.



GEM Gas Exhaust Mitegation

