

## **RADON WELL/SUMP BASIN FOR NEW HOME CONSTRUCTION**

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### **ABSTRACT**

This paper will describe a radon-well/sump-basin (patent applied for) for installation in new home construction as well as an insert for retrofitting to existing sump-holes. The design will meet all EPA mitigation standards for sealing sump-holes. The advantages of the design are: 1) It will accommodate either a submersible or pedestal sump-pump, 2) The sump pump may be viewed and/or replaced without breaching the seal, 3) The need to add a floor drain when sealing the sump hole is eliminated, 4) The need to install water traps and/or condensate pumps on condensate and stair-well drain drains is eliminated, 5) the need to install a check valve on the sump pump discharge line is eliminated, and 6) The retrofit version may be installed in minutes by relatively un-skilled home owners.

### **BACKGROUND**

The basic radon mitigation technique widely practiced is to simply seal accessible cracks, crevices, and other discernible openings in a building's foundation. This technique alone however, has been found to be insufficient in significantly reducing radon levels in given building structures. A more effective radon mitigation technique is known as sub-slab depressurization. This technique essentially seeks not only to adequately seal all cracks and other openings in the building's foundation slab, it also depressurizes the space beneath the slab thereby sucking out the radon before it is sucked into the building by negative pressures within the structure.

In certain areas of the United States, and elsewhere, it is common practice to install drainage fields and sump basins beneath the foundation slabs of structures to collect and discharge seepage water that may otherwise collect in cinder block walls and beneath the slab. These drainage fields and sump basins also provide a convenient collection point and entry mechanism for radon. The sump basin and drain field therefore serve as a convenient plenum chamber for creating and extending a low pressure field for the removal of radon.

It is common practice by radon mitigation contractors to apply suction to a sump basin to suck the radon out from under the slab before it enters the structure. When performing radon mitigation on homes that have sump holes and drainage systems installed, this sub-slab depressurization technique is the prevalent radon mitigation technique. A few notable disadvantages are inherent in this technique. First, a custom fitted precisely-crafted sump basin cover is an absolute necessity, as it serves as the critical seal for the sump basin. This requires not only that the cover be affixed to the collection basin to effect an adequate seal, it requires that any object passing through the cover be passed in a sealed manner. This, in turn, requires that the passing object not be movable, less the seal between that object and the cover be broken. Therefore it is mandatory that any existing pedestal type sump pump assembly be replaced by a submersible type sump pump.

Other inherent disadvantages associated with sealing of the sump basin are brought to light by Radon Mitigation Standards established by the United States Environmental Protection Agency. These standards require that a working floor drain must be installed when sealing the sump basin, and a recommendation to include a view port. The formation of an adequate floor drain and view port, typically installed in the cover of the sump basin which does not compromise the strength, durability, or the airtight seal, further adds to the complexity and cost of

the sump basin cover. Additional requirements imposed by the EPA Mitigation Standards is the need for water traps on condensate and stair-well drainage conduits, and check valves on water discharge conduits. These later requirements are intended to enhance the extension of the low pressure field, and to reduce the potential for back drafting of combustion devices.

Due in large part to the complicated nature of the steps required to install a sub-slab depressurization radon mitigation system, especially when the home has a sump pump to contend with, the technique requires mechanical skill, it becomes rather time consuming and expensive, and consequently, many beneficiaries of radon mitigation systems continue to endure the harmful effect of radon gas. A radon mitigation technique that is simpler, less complicated, less time consuming, and less expensive than currently known radon mitigation techniques is urgently needed.

## **RADON RESISTANT FEATURES IN CONTEMPORARY RESIDENTIAL CONSTRUCTION**

Many new home builders are incorporating radon resistant features during construction, much of which is inadequate and not properly installed in accordance with EPA mitigation standards. These features include: 1) Vent pipes that are installed in the slab and are routed through the roof, 2) Sealing of the floor wall joint, 3) Sealing of sump basin covers, and 4) Installation of vent pipes that exit the side of the house.

Most of the built-in mitigation features consist of sealing activity and installing of vent pipes. Some vent pipes feed through outside walls to exit the roof and make it impossible to install a fan that will meet EPA standards. In some installations two vent pipes have been installed, each at opposite ends of a basement slab and vented to the exterior of the house. Presumably to provide cross ventilation of the sub-slab area, and in some installations these pipes are 2" PVC. In other instances the vent pipes have been set directly on the earth or on top of the moisture barrier, which results in zero air flow when an exhaust is connected. Rarely is there any consideration as to the location of the vent pipe in the structure's attic by the installer, in many instances these pipes are located toward outside walls near the eaves, allowing no room for an exhaust fan, or even means of accessing the pipe. There are vent pipes that exit under decks and windows. And, most importantly, sump basins are simply sealed (quite often poorly)...no view ports, floor drains, water traps, etc. Radon mitigators must first un-do what has been installed and start from scratch.

## **THE RADON WELL**

The primary object of the "RADON WELL" (patent applied for) is to provide a plenum chamber that is isolated from and effectively sealed from the sump-basin. The radon well could be a stand alone device without a sump pump installed. However, as a sump basin has a affinity to act as a conduit for radon, so does the radon well have an affinity to collect water. Therefore to be effective, the radon well must be equipped to separate radon from water and independently discharge each from the structure by means of independent conduits.

The "RADON WELL" design provides for both functions, adds little cost to the construction, and provides a simple and economical means of mitigating elevated concentrations of radon from a building structure. The "RADON WELL" accommodates either a pedestal or submersible sump pump, eliminates the need for water traps, condensate pumps, view ports, check valves, flexible couplers on the vent pipe, and the need to breach the sump cover seal in order to replace/repair the sump pump.

The system configuration as shown in Fig. 1, TYPICAL-RADON WELL/SUMP BASIN INSTALLATION is intended for installation during new home construction. A separate version is available for retrofit to existing sump holes. The "RADON WELL" is installed in the same manner as a sump basin into which perforated drain tile are discharged. The side wall of the "RADON WELL" is constructed with an upper portion 210 that extends well below the opening and a lower portion 230 which is separated by a shoulder area 220. The upper portion is of

sufficient depth to allow for the discharge of condensate and/or floor drain conduits 5, 8 directly into the sump-basin. These conduits are inserted above the shoulder 220, at ambient air pressure, to isolate them from the radon plenum chamber 400 which is at negative pressure. The plenum chamber is defined as the volume of air below the shoulder and between the lower portion of the "RADON WELL" 230 and the outer wall of the abbreviated sump basin 300. These conduits are installed through grommets to create a seal between the inner cavity of the "RADON WELL" and the area under the slab.

An abbreviated sump-basin 300 is installed in the lower portion of the "RADON WELL" 230 to isolate and seal off the "RADON WELL" basin from room ambient atmospheric pressure. The sump basin rim 410 rests on the "RADON WELL" shoulder where it forms a seal. The volume of air 400 between the sump-basin wall 300 and the lower portion of the "RADON WELL" 230 defines a plenum chamber to facilitate the extension of the low pressure field, generated by an exhaust fan, to the perforated drain conduits 4. A one way valve is installed at the lower extremity of the sump basin to allow the flow of water from the "RADON WELL" into the sump basin for eventual discharge to the exterior of the building structure by means of a sump pump.

Since the cavity of the sump-basin is sealed and isolated from the "RADON WELL" plenum chamber, and therefore at room ambient air pressure, the sump pump may be either a submersible or pedestal type pump, and the sump basin need not be sealed. The need for view port, floor drain, water traps, check valves, and flexible couplings are also eliminated.

During construction of a building structure, the location of the "RADON WELL" and the vent pipe should be given careful consideration. The "RADON WELL" may be located in any convenient location as long as there is a drainage conduit coupled directly to the vent pipe leading through the attic and roof. The vent pipe should be located as close to the attic hatch as possible, and electric power should be in place within several feet of the vent pipe. Any one who has climbed into and crawled his way to a vent pipe in hot dirty attics will appreciate this consideration.

### **ACTIVATION**

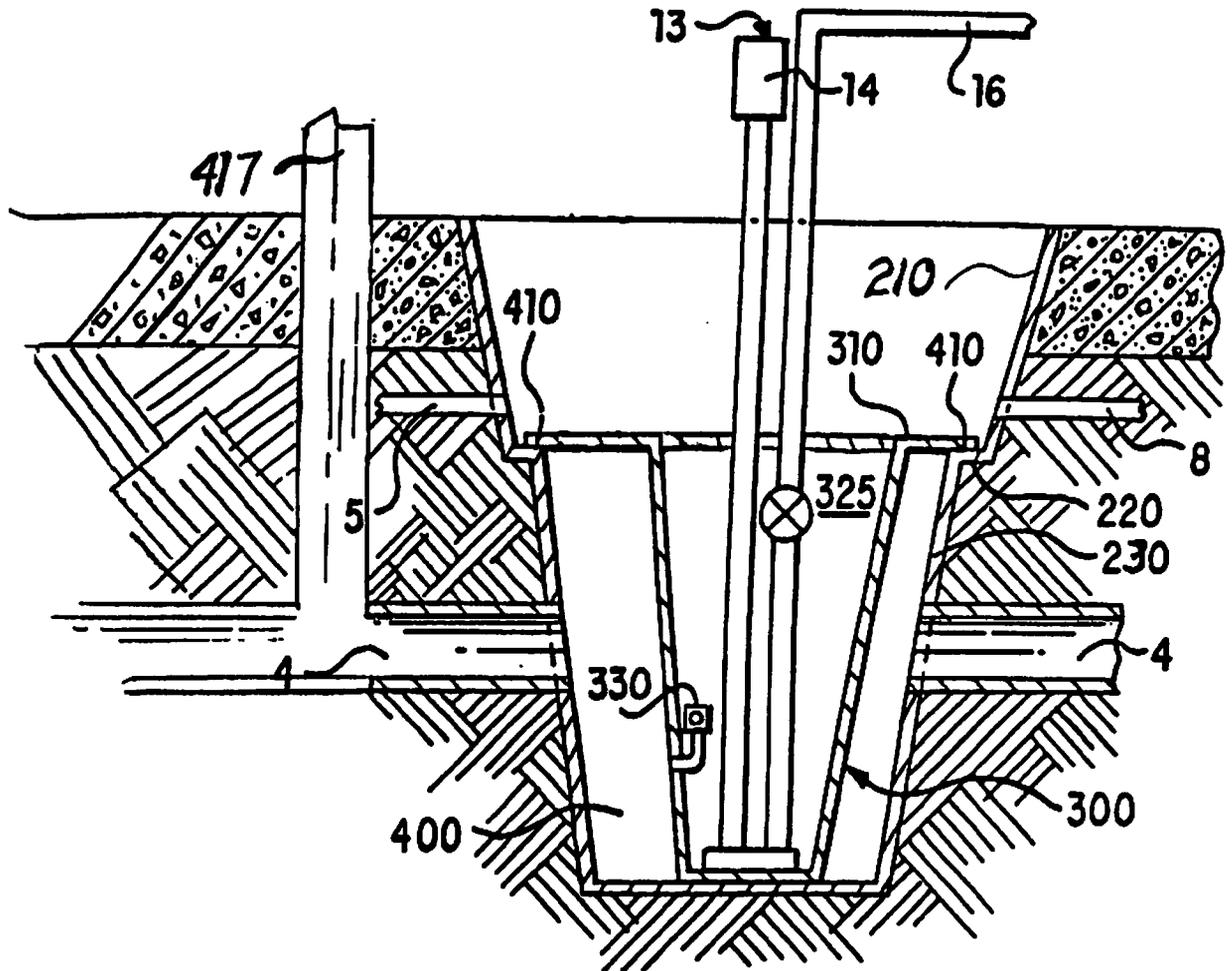
The final phase of the radon mitigation process is in place and ready for activation. The next action is to perform a radon test. In the event there is radon concentrations of concern, it is a simple chore to open the attic hatch, cut the radon vent pipe, install an in-line exhaust fan, and supply electrical power. Perform a post mitigation radon test and sit back and breath easy.

### **RETRO FIT CONVERSION KIT**

Fig. 2 depicts a typical installation of a "RADON WELL CONVERSION KIT" (patent applied for) for an existing sump basin. You will note that what was the sump basin has become "RADON WELL" and the insert is the sump basin. The theory of the installation is identical to the radon well for new construction except for the fact that there is no standard sump basin. Existing sump basins vary in diameter, depth, material, tapered sides, and vertical sides. And many existing sump basins have condensate and stair well drain conduits to contend with. A standard 20 inch sump basin will accommodate the type of conversion kit shown in Fig. 2.

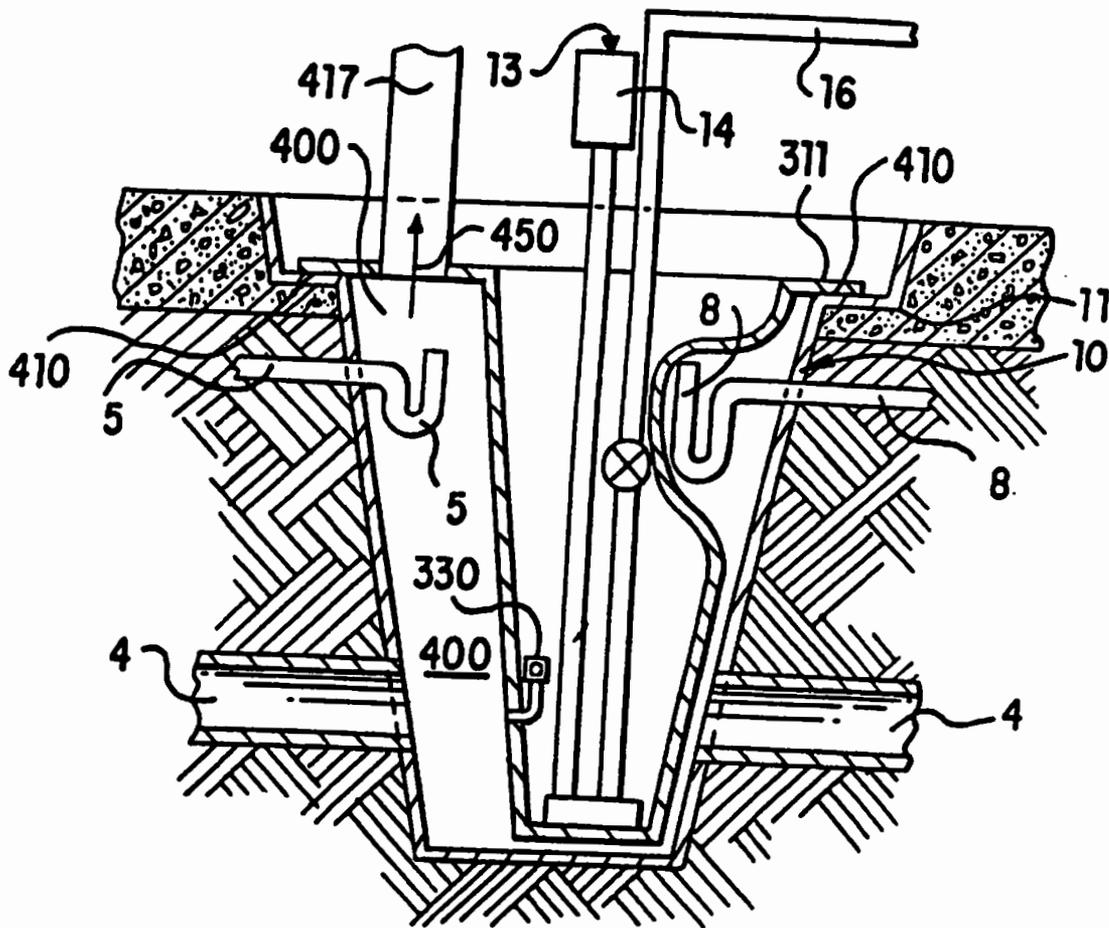
Several versions of the conversion kit are being developed which include a selection of diameters, flexible side walls to accommodate the protrusion of condensate and drain lines, and adjustable depths. Installation of the conversion kit is simple: 1) Cut the discharge conduit in a convenient location and remove the sump pump, 2) Install waster traps as required, 3) install the conversion kit and seal the rim area to the sump basin, 4) re-install the existing sump pump using a flexible coupler, fini.

The first installation of a conversion kit took 40 minutes to install because the existing sump pump was defective and needed to be replaced. The entire process should take no longer than 15 to 20 minutes.



**FIG. 1 TYPICAL RADON WELL/SUMP BASIN INSTALLATION**

- 4 -DRAINAGE SYSTEM PERFORATED DRAIN TILE**
- 5, 8-CONDENSATE AND FLOOR DRAIN CONDUITS**
- 210-RADON WELL UPPER PORTION**
- 220-RADON WELL SHOULDER**
- 230-RADON WELL LOWER PORTION**
- 300-SUMP BASIN**
- 310-SUMP BASIN RIM**
- 325-SUMP BASIN CAVITY**
- 330-ONE WAY WATER VALVE**
- 400-RADON WELL PLENUM CHAMBER**
- 410-SEAL BETWEEN RADON WELL AND SUMP BASIN**
- 417-PVC VENT PIPE FOR RADON EXHAUST**



**FIG. 2 TYPICAL RADON WELL CONVERSION KIT INSTALLATION**

- 4 -DRAINAGE SYSTEM PERFORATED DRAIN TILE**
- 5, 8-CONDENSATE AND FLOOR DRAIN CONDUITS**
- 220-RADON WELL SHOULDER**
- 10-RADON WELL LOWER PORTION**
- 300-SUMP BASIN**
- 311-SUMP BASIN RIM**
- 325-SUMP BASIN CAVITY**
- 330-ONE WAY WATER VALVE**
- 400-RADON WELL PLENUM CHAMBER**
- 410-SEAL BETWEEN RADON WELL AND SUMP BASIN**
- 417-PVC VENT PIPE FOR RADON EXHAUST**