



[www.cupolex.ca](http://www.cupolex.ca)

**PONTAROLO**  
**ENGINEERING** 



## CUPOLEX® VAPOR INTRUSION MITIGATION

Soil gas mitigation is increasingly considered as a pre-emptive strategy at sites impacted with volatile contaminants, radon or naturally-occurring biogenic gases (e.g., methane). For new building construction, there is a range of possible mitigation solutions, which often involve modification of the building envelope in contact with soil to incorporate soil gas venting and/or barrier systems. CUPOLEX® Aerated sub-floors provide a sustainable approach for soil gas mitigation and are more permeable than gravel layers, and thus are more efficient in term of venting characteristics.

While there are numerous reasons why the CUPOLEX® system outperforms the standard liner or gravel layer SSV system, there are three critical factors that make the CUPOLEX® system the superior system for your project, as well as the better choice for the sustainability and economics of the project.

These factors are:

- more effective venting,
- constructability, and
- long-term maintenance costs.

### APPLICATIONS

- Single and multi-residential dwellings
- Commercial buildings
- Institutions and hospitals
- Light and heavy Industrial buildings
- Adaptable to any type of slab foundation design



### ADVANTAGES

CUPOLEX® aerated floor systems control vapor intrusion by either diluting sub-slab concentrations to levels of no concern (the innate attenuation that any reasonable slab provides means that sub-slab concentrations do not have to be reduced to indoor air action levels), or by depressurizing the sub-slab void space to prevent upward flow of air into the building. Advantages of CUPOLEX® sub-floor venting include:

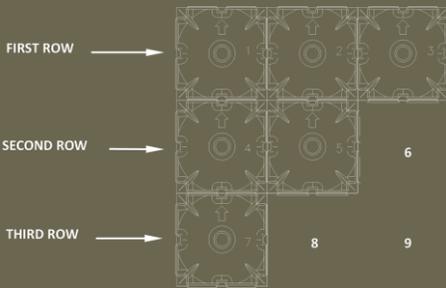
- provides a highly efficient under-slab void network than less efficient sand or gravel venting layers
- More Efficient Venting
- Passive Venting Potential
- CUPOLEX® floors do not require membranes
- low capital cost,
- fast assembly and can be installed by any concrete slab contractor or forming contractor
- the ability to cut the slab at any location and easily repair,
- the ability to easily test, monitor and enhance performance

# ASSEMBLY

CUPOLEX® provides Excellent Flexibility in Working with new construction or remodeled building layouts. The main characteristics of the forming system are speed and simplicity, with maximum benefits being realized when the CUPOLEX® system is engineered during the early design stages in assessing site and soil conditions, considering elevations of various sections of the slab area that may have to be raised or for example if strip footings, walls or other typically formed sections can be incorporated within the system, cost savings and environmental benefits can be realized.

**On average two laborers set 140 m<sup>2</sup>/hr (1500 sf/hr)**

- Layout complies with a grid system
- Each CUPOLEX® Form has an installation arrow
- Forms are Installed by starting from left to right and top to bottom
- Ensure that the feet connection pins are correctly inserted into their holes
- Pouring and finishing of the concrete slab in the conventional manner



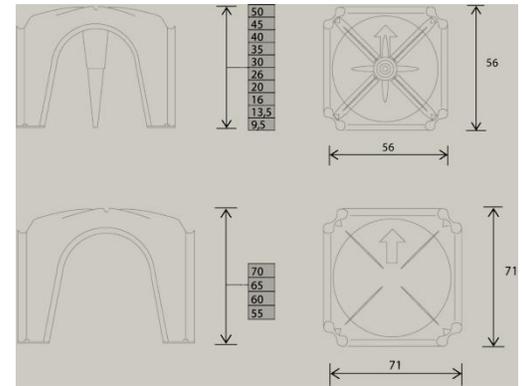
## THE CUPOLEX® ELEMENTS

CUPOLEX® Plastic Dome Concrete Forms are stay-in-place forms to create unreinforced or reinforced concrete slabs on grade and other concrete structures. Concrete is poured over the modular dome forms to create floating or structural slabs on grade. The unique concrete geometry Cupolex creates, forms an under slab void that can be vented to remove moisture and soil gases or provide solutions for various sustainable construction applications - uses less concrete and reinforcing than a standard slab with equivalent load bearing capacity.

CUPOLEX® Patented Forms have unique connecting features. Only, CUPOLEX® forms additional built-in plastic at all pressure point locations and a central reinforced cone support of equal height to the element and positioned in correspondence of the central region, guarantees the absorption of vibrations which occurs during the finishing of the concrete Aerated floor slab.

## CUPOLEX® FORM HEIGHTS

Cupolex forms are available in various heights to suit any site conditions or design requirements. Made from 100% recycled Polypropylene (PP) plastic, the forms provide the maximum performance and guarantees superior characteristics of stability and resistance in its structure to allow operations that are completed directly above the plastic CUPOLEX® elements before and during the placement of the concrete.



## ANCILLARY PRODUCTS

**PONTEX®** - The PONTEX® element combined with CUPOLEX® used to create beams or as stiffening ribs for structural concrete slabs & pavements.

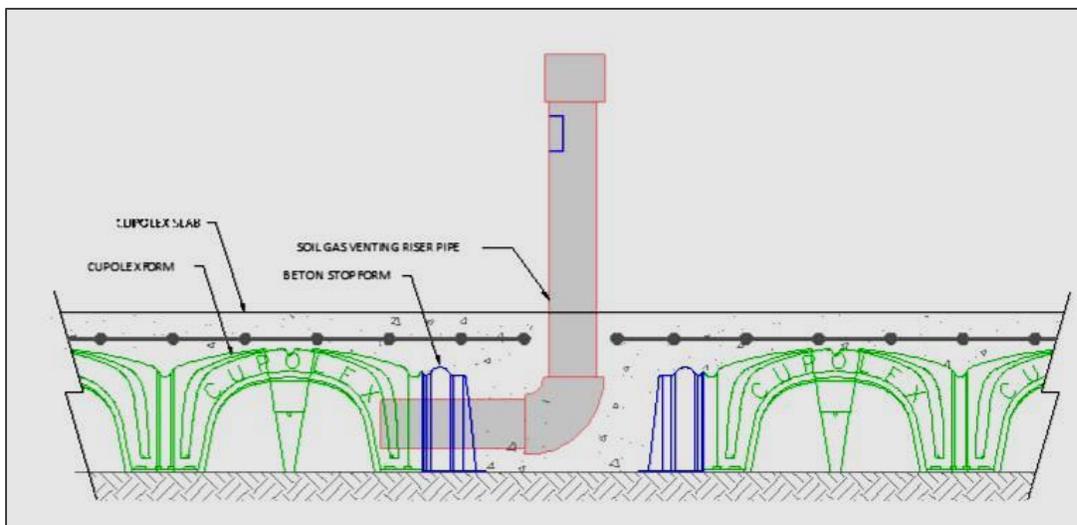
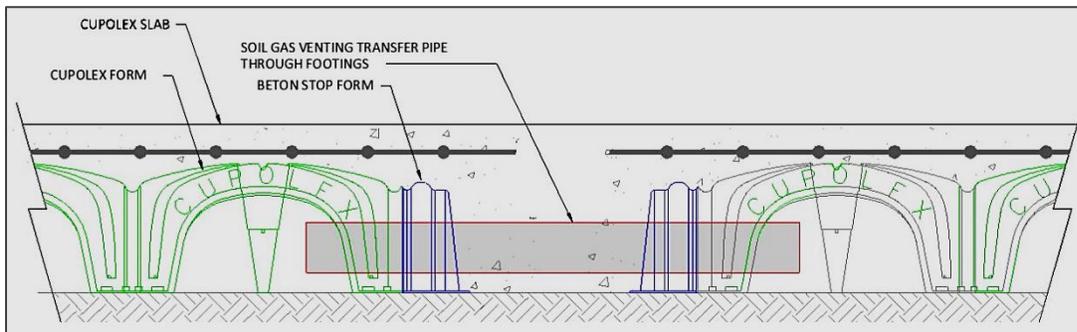


**BETON STOP®** - The BETON STOP® element for closing the side openings of the CUPOLEX® forms.



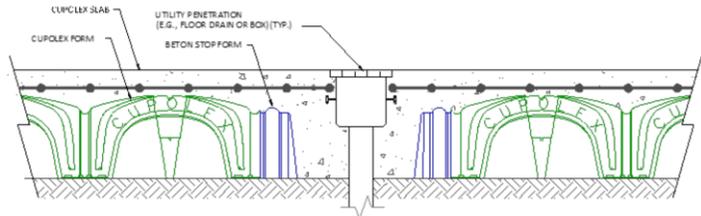
## HOW CUPOLEX® FLOORS PROTECT BUILDINGS FROM VAPOR INTRUSION

- provides a highly efficient under-slab void network for a more effective application of SSD, at a lower cost than the less efficient sand or gravel venting layers.
- provides a far more efficient, effective, and predictable medium for moving air than soil.
- provides new opportunities for passive venting, with a network of open voids that allows air to move much more easily under natural thermal gradients or wind.
- aerated floor system that rely on ventilation or depressurization (diverting and diluting the vapors) do not require membranes.
- mitigation systems that result in the dilution of vapors below the floor and whose performance can be monitored and controlled (e.g., through fan operation and pressure measurements) have the advantage of not allowing vapor concentrations and pressures to build immediately below the building, which is not always the case with barrier systems.
- With CUPOLEX®, Designers, Builders and Developers can provide cost effective preemptive mitigation control measures in new buildings and homes while saving concrete usage, reducing building cycle time and minimizing engineered fill requirements.
- With CUPOLX®, Designers, Builders and Developers can provide cost effective preemptive passive provisionally active designed mitigation control measures in new buildings and homes while saving concrete usage, reduce building cycle time and minimizing engineered fill requirements.



## FEATURES

- Comparison of the void response curves to fan curves indicates a relatively small low-power fan is capable of venting an aerated sub-floor for a relatively large building footprint.
- no measureable pressure losses in the aerated sub-floor
- Given the low capital costs and minimal power requirements for small fans capable of depressurizing and venting an aerated sub-floor, the use of wind-driven turbines is considered best suited as a low-maintenance measure in the absence of a demonstrated necessity for a venting system.
- An active system provides the added certainty of effective performance. Although it may be possible to adequately ventilate aerated sub-floor for certain larger commercial buildings using a single relatively small fan, multiple risers and fans may be needed for redundancy and to improve distribution of air flow, particularly when the aerated sub-floor is not continuous below ground due to grade beams. Where possible, the void space should be continuous. Where this is not possible, closely spaced air transfer pipes (one pipe per 3 metre separation between voids) should be used to minimize frictional losses. The exhaust riser entrance and riser pipe system should be designed to minimize losses.



## SUSTAINABLE SOIL GAS MITIGATION SYSTEM

The sustainability or optimization of soil vapour mitigation systems can be approached in several ways, including optimizing design criteria for vacuum and/or air flow rate, reducing friction losses (primarily through use of CUPOLEX® aerated floors), and use of passive forces or low-power fans. Passive forces such as wind turbines and temperature differences (stack effect) can potentially result in significant venting air flow rates; however, they are constrained by frictional pressure losses. The use of CUPOLEX® aerated sub-floors presents advantages over conventional gravel venting layers through significantly reduced frictional losses.

Vapour intrusion modeling studies, conducted using a version of the Johnson and Ettinger model modified by Golder & Associates to include venting of a subslab layer, was completed to predict indoor vapour concentrations for a commercial building with a SSV system, constructed above a TCE plume in groundwater. Modeling results indicate elimination of building depressurization and thus soil gas advection reduced the vapour attenuation factor by two orders-of-magnitude, and that there were further order-of-magnitude decreases in the attenuation factor when the CUPOLEX® aerated sub-floor was ventilated. This modeling approach, together with scoping calculations of air flow and pressures, provide an approximate quantitative basis for venting system design.



## DESIGN & ENGINEERING

We provide PE stamped shop drawings through our engineering partners globally, construction training, and installation observation and we work closely with the design team, the contractor, and the owner to ensure the success of the project. Each site is different, and working with project partners to find installation solutions that address specific site needs is a part of the service we provide.

To begin using the CUPOLEX® for your Brownfield redevelopment project or as a preemptive building control measure at your site, visit our Solutions page at [www.cupolex.ca](http://www.cupolex.ca) for a step-by-step road map on using this product.

**PONTAROLO**  
**ENGINEERING**

PATENTED

