Underfloor Air

HAWORTH®

The Science of Underfloor Air

For a floor to truly support a workspace, it has to do more than just sit there.
As technology and tenants change, underfloor air distribution keeps the building fresh.

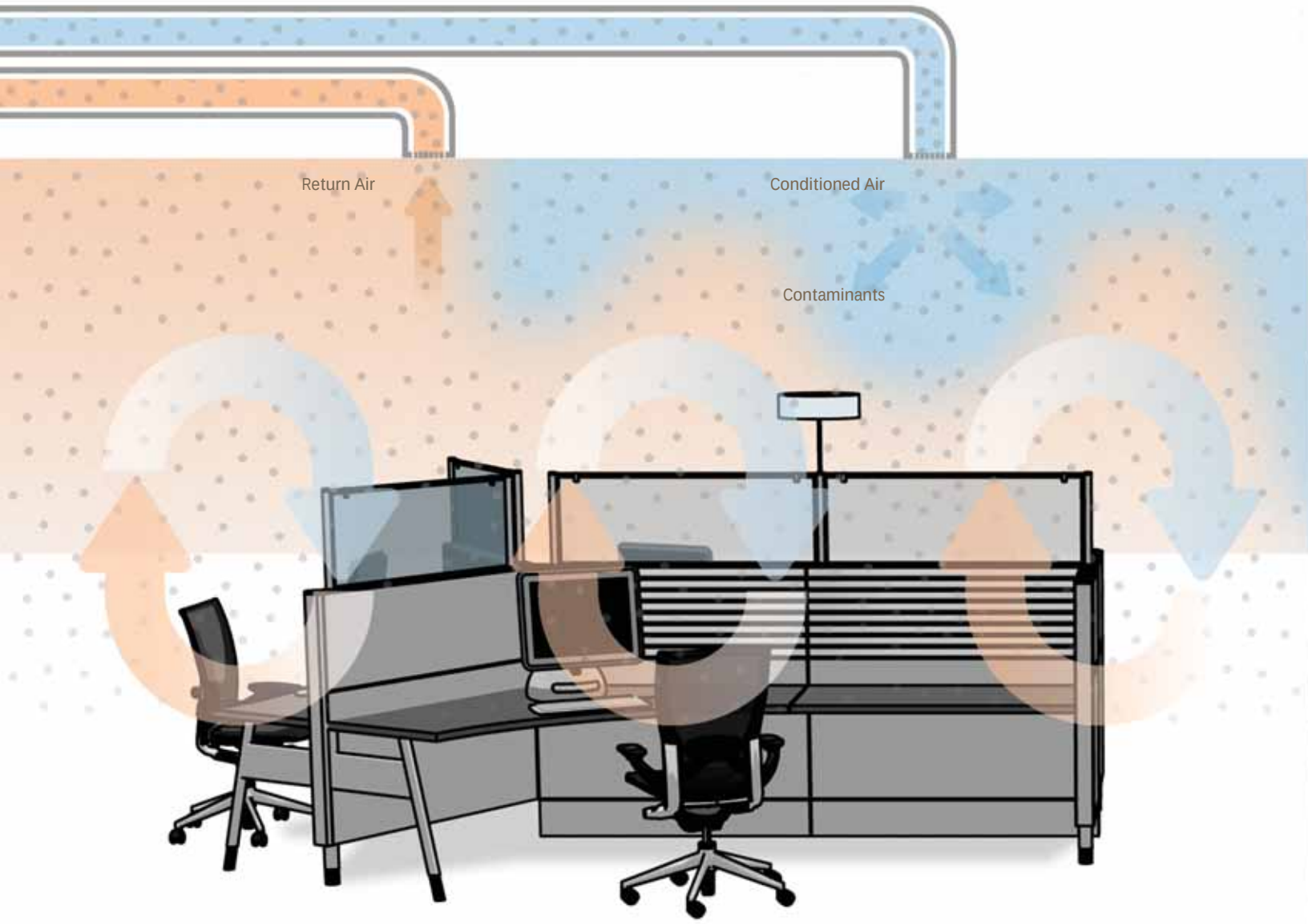
Fresher Design

Developers, building owners and architects face a complex challenge: build buildings that are not only pleasing aesthetically, but are also efficient, flexible and smart. Designers and builders must create structures that can be constructed economically, operated efficiently and be ready to change at a moment's notice. Distributing air through the floor can go a long way toward accomplishing those objectives.

Popular in Europe and Japan for many years, underfloor air distribution is now making inroads in North America. As raised access floors become a preferred means of delivering voice, data and power, developers recognize the added value those floors can provide as a means of air distribution. Underfloor air technology can improve indoor environmental quality, reduce construction and operating costs, and boost productivity by giving occupants greater control over their environment and their comfort.

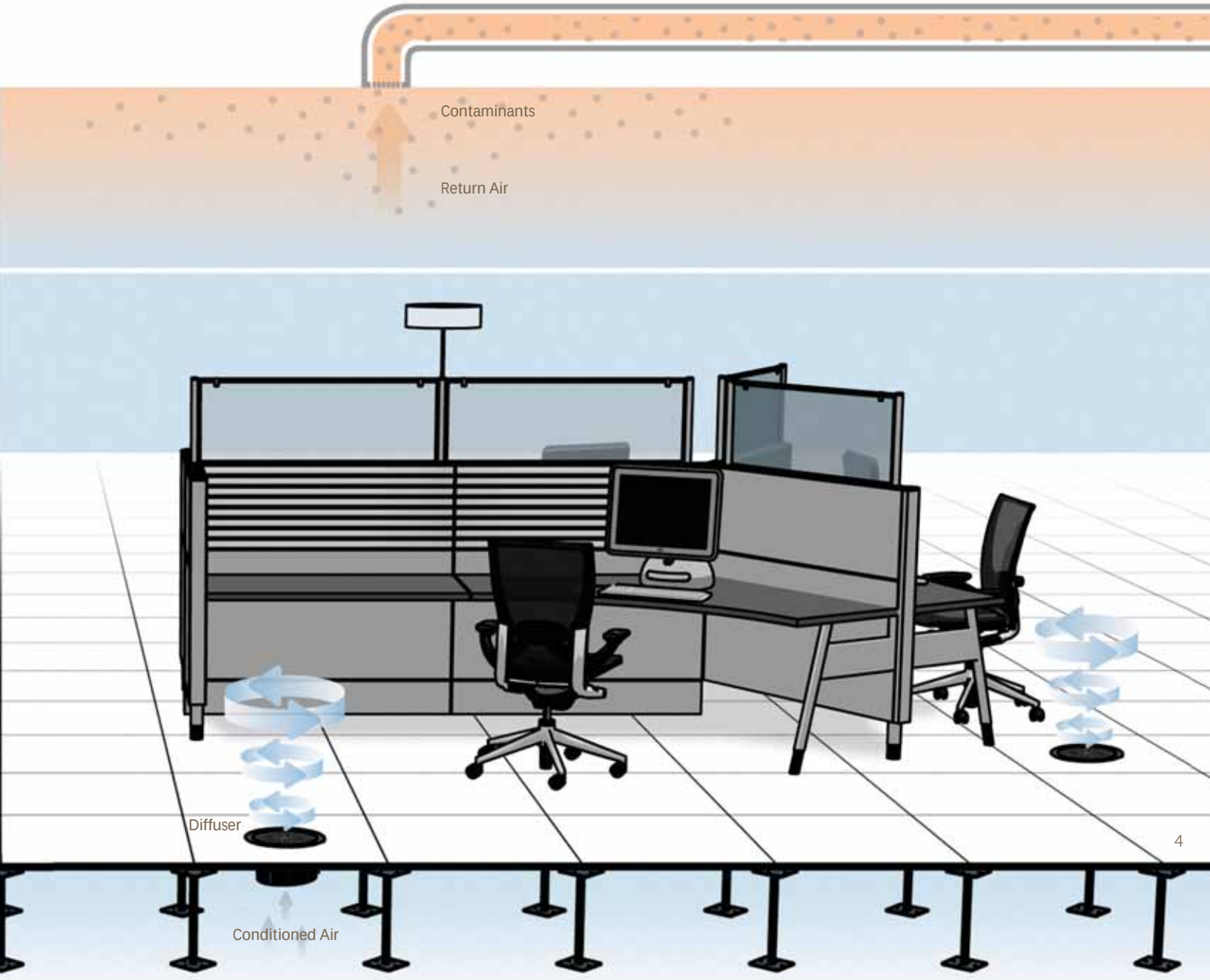
How It's Different:
Overhead vs. Underfloor Air Systems

In a conventional system, conditioned air is introduced from or near the ceiling and mixed completely with room air to avoid drafts. Complete mixing of the supply and room air creates near-uniform temperatures throughout the space.



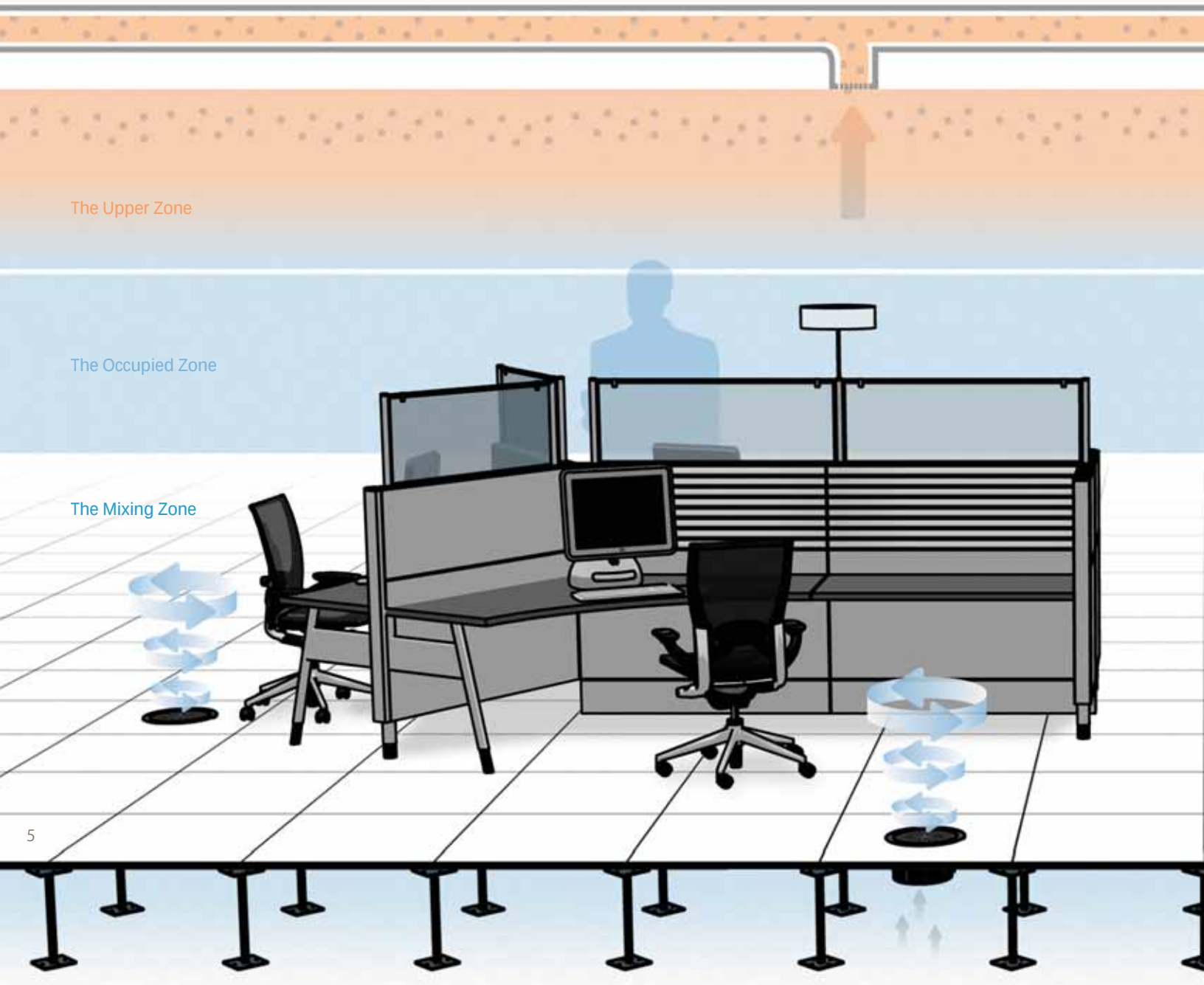
Underfloor Air Systems

With an underfloor system, the cavity created by the installation of the raised access floor is used as a supply air plenum. Conditioned air is introduced to the occupied space through floor outlets. The floor outlets, or “diffusers”, are designed to rapidly mix the conditioned air with the room air. Rather than being forced, the new air rises naturally, carrying heat and pollutants upward and out the ceiling air return.



How It Works: The Three Zones

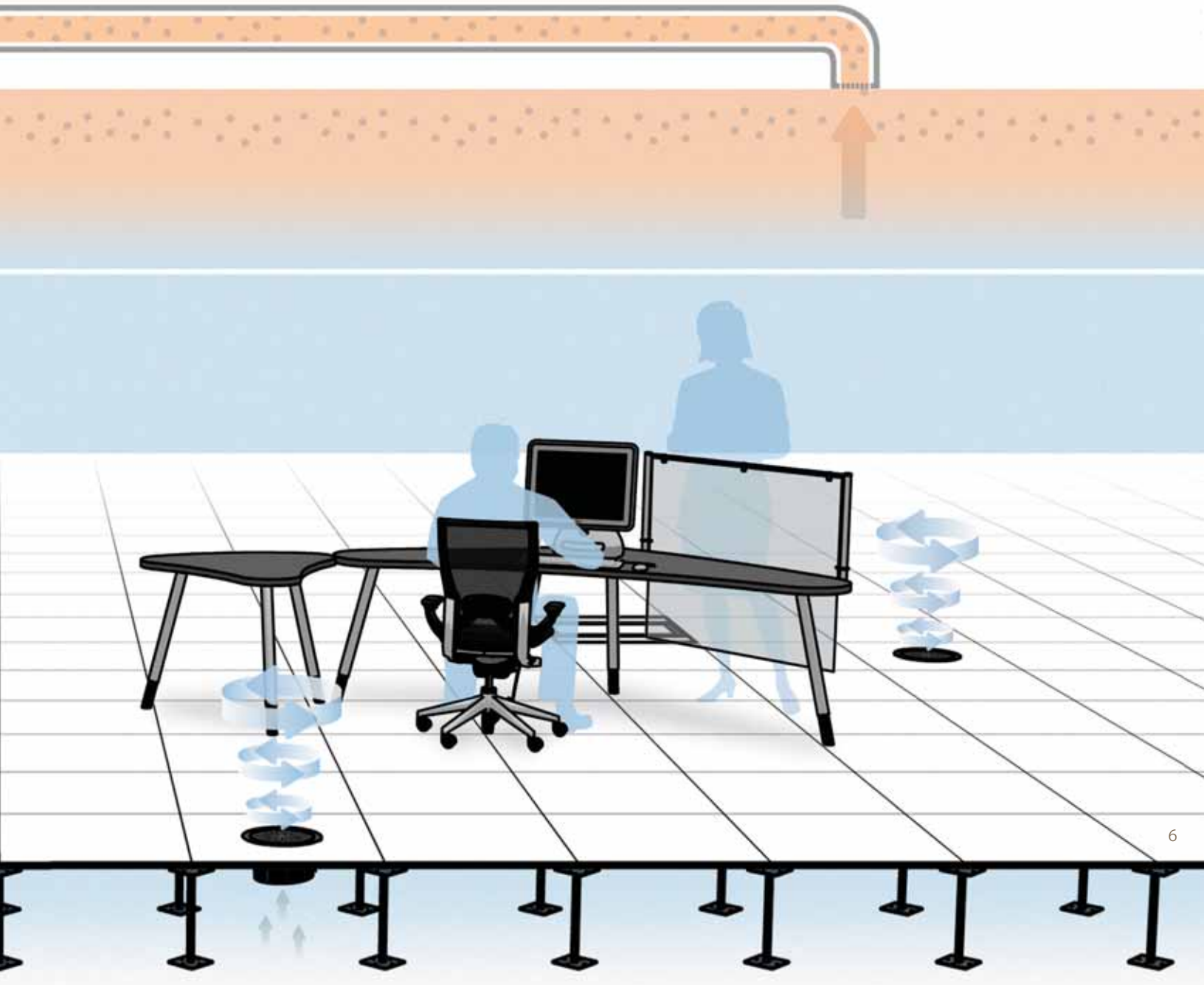
When conditioned air is supplied through the floor, room air stratifies into three layers or "zones." The hot, stale air is always kept on the topmost level, away from the occupants. The depths of these three zones are dependent on the ceiling height and type of floor outlet used.



The mixing zone is three to four feet above the floor. Conditioned air enters at the bottom of this zone, rapidly mixing with room air, which minimizes uncomfortable drafts for occupants near the floor outlets. Then, through natural convection, the air rises to the occupied zone.

The occupied zone is a band of air that starts four feet off the floor and ends at around six feet. The air in this zone is at optimal temperature and air quality.

The upper zone is between six feet above the floor and the ceiling. This is where temperature and contaminants are at their highest. Heat and airborne pollutants rise into this zone and collect at the ceiling for removal through the return air duct.



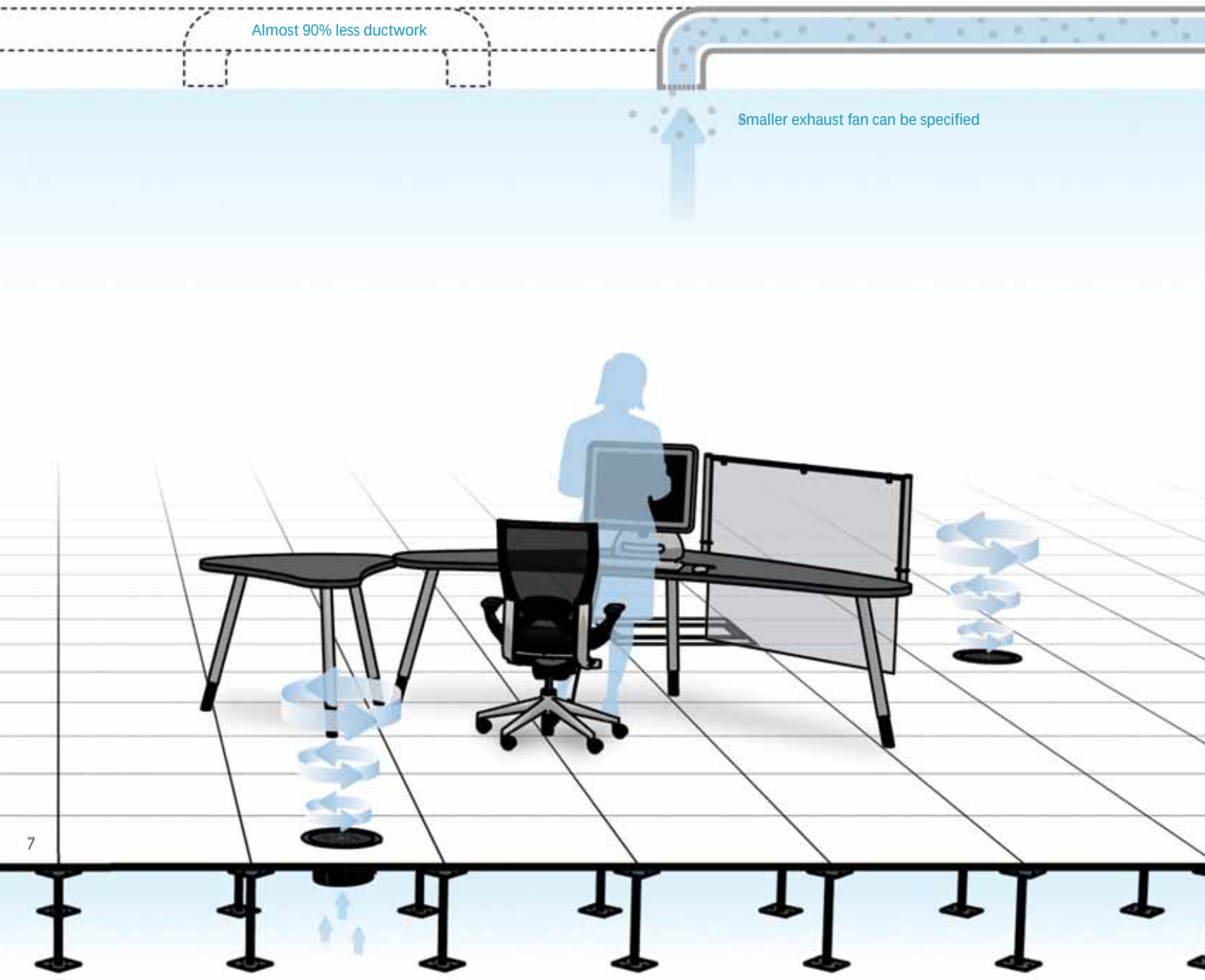
Why It Matters: The Advantages

The design objective for underfloor air systems is simple: achieve the optimal temperature and air quality in the occupied space, allow for easy reconfiguration of the air delivery system, and reduce operating expenses.

Faster, Cost Effective Construction

At first glance, raised floors may appear to be slightly more expensive than conventional floors. But when you use the space below the floor for air distribution and power and data cabling, that apparent cost premium vanishes. In fact, **overall cost per square foot** for an access floor-based system may be as much as two dollars less than conventional construction.

- No steel beam penetrations for ductwork are required.
- Lower fan static pressures and reduced airflow requirements mean smaller supply and exhaust fans.
- Since conditioned air moves in the cavity between the raised floor and floor slab, nearly 90% of ductwork is eliminated.
- The little ductwork that is used doesn't need to be insulated. That's because conditioned air is isolated in the floor cavity, rather than sharing the ceiling cavity with warm return air.

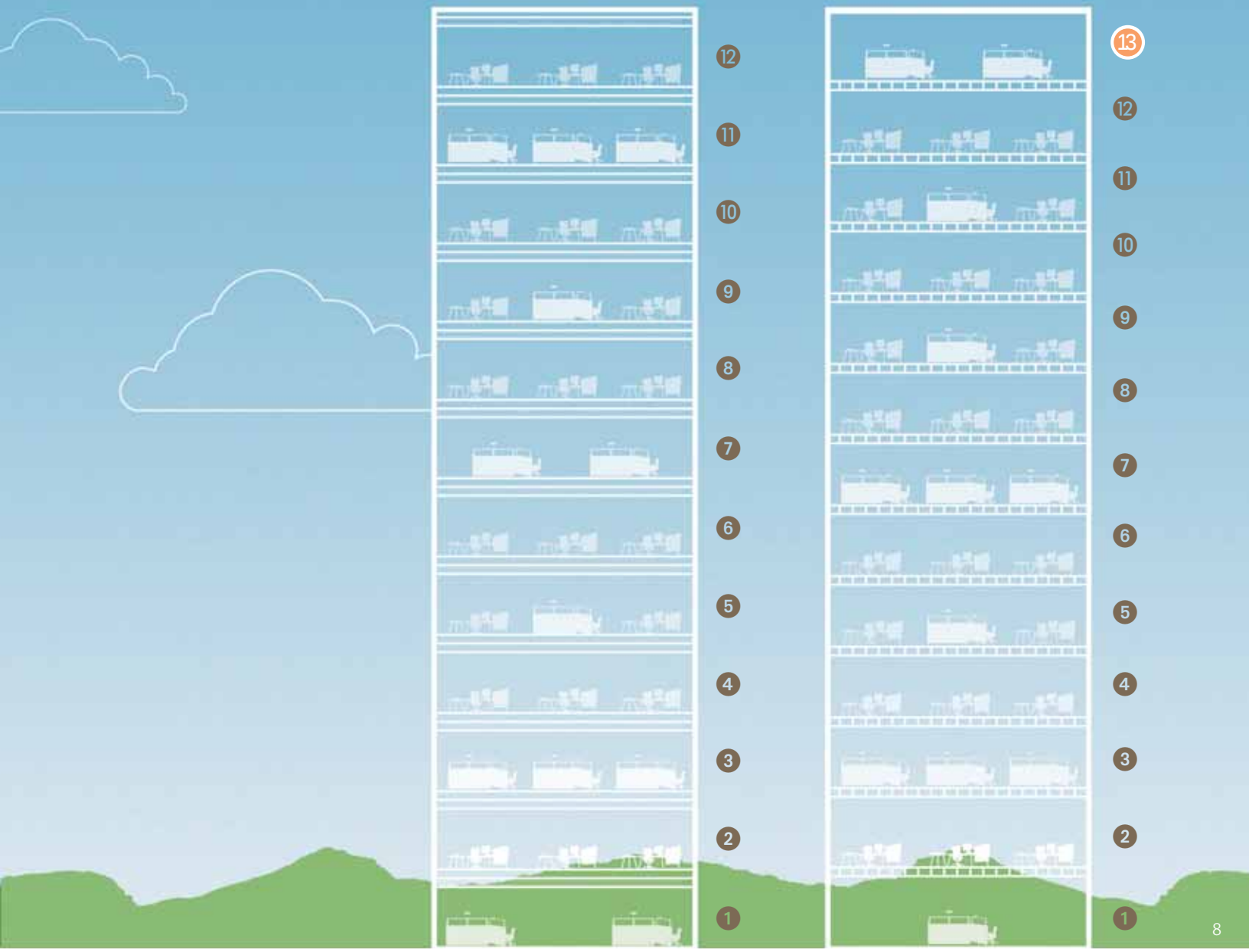


Smaller building shells are possible because underfloor air requires a shorter cavity than the overhead systems. Thirteen floors can often fit within a shell that would normally house twelve.

Compressed Construction timelines can be achieved through the use of access flooring. It takes significantly less time – sometimes as much as 30-40% less - to install utilities under the floor than it does to install those utilities overhead.

Faster financial payback can be achieved with buildings designed to completely utilize the benefits of a raised flooring through increased usable space and reduced cost of mechanical equipment.

The life cycle cost of savings associated with the reduction of churn costs can often pay back the initial investment in a raised flooring system within a few years.



Building with overhead HVAC.

Twelve floors.

Building with underfloor air.

Thirteen floors. Same height.

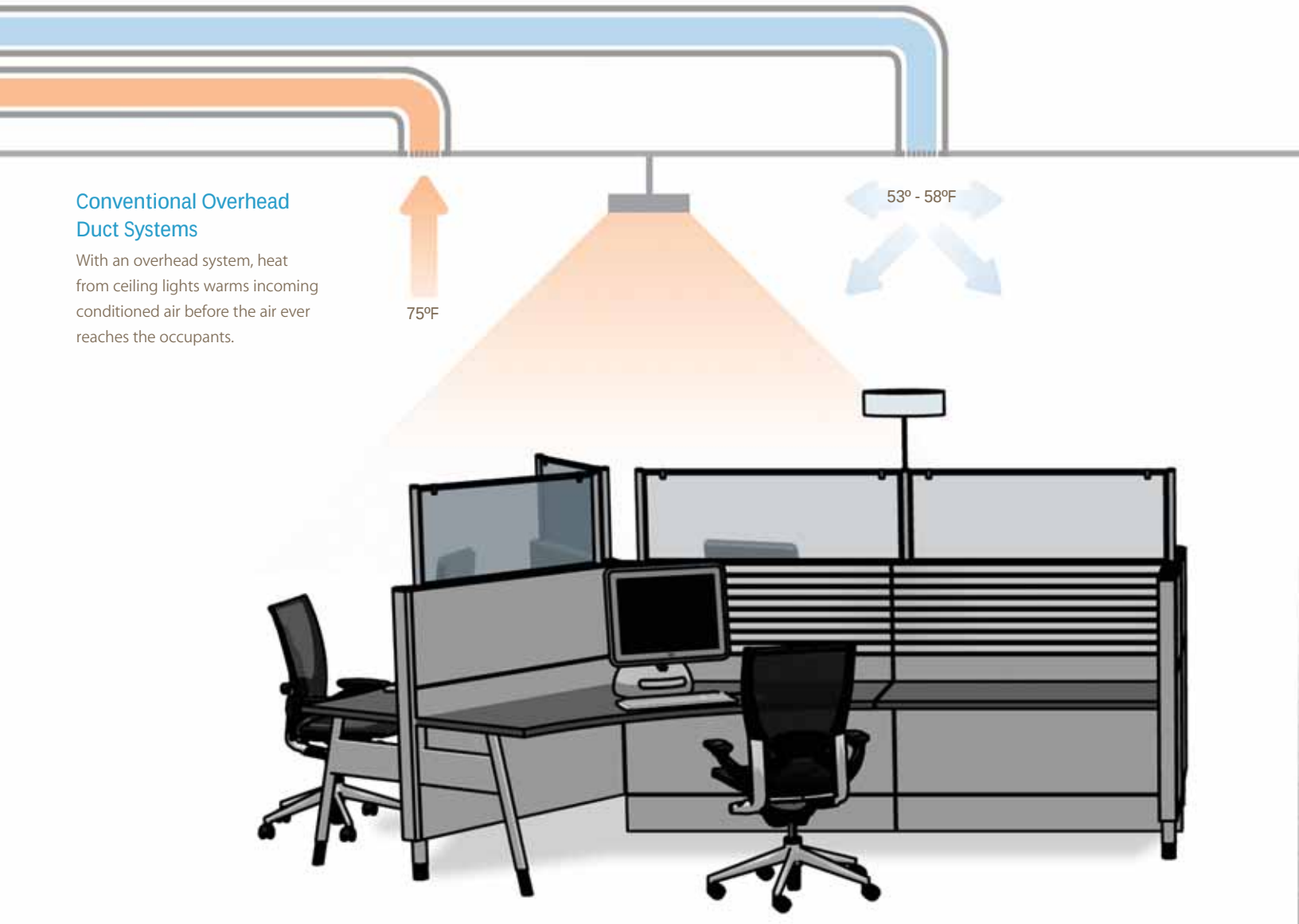
Lower Energy Costs

Aside from reducing the costs of the HVAC system and subsequent building maintenance, underfloor air systems also use energy much more efficiently than conventional systems. Here's why:

Increased Chiller Efficiency –
For an underfloor system, the return air temperature is usually 82° to 84°F, compared with about 75°F for overhead systems. This results in warmer return water temperatures, allowing chillers to operate with greater efficiency.

Greater Opportunities for Free Cooling –
Supply air is typically introduced at about 63° to 68°F, compared with the 53° to 58°F used for overhead systems. In regions with mild humidity, it also allows longer periods during which outdoor air is used for free cooling.

In many cases, the building floor slab can be used as a heat-absorbing thermal mass, which can reduce the cooling requirements in some northern climates.

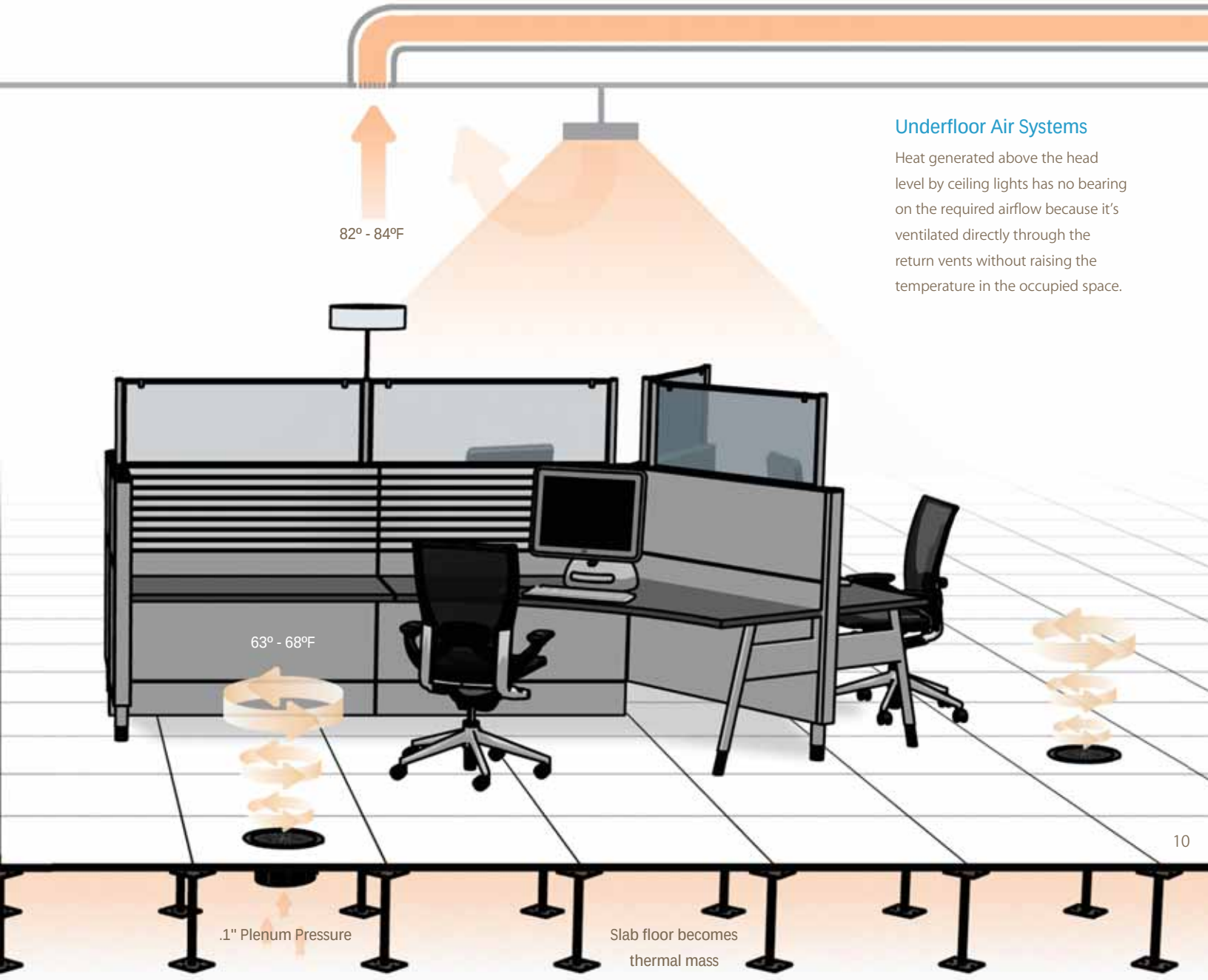


Conventional Overhead Duct Systems

With an overhead system, heat from ceiling lights warms incoming conditioned air before the air ever reaches the occupants.

More Efficient Ventilation –

Less ductwork also leads to lower static pressures, which reduces fan power requirements and operating costs. The underfloor plenum requires only .1" water column pressure or less to perform properly.



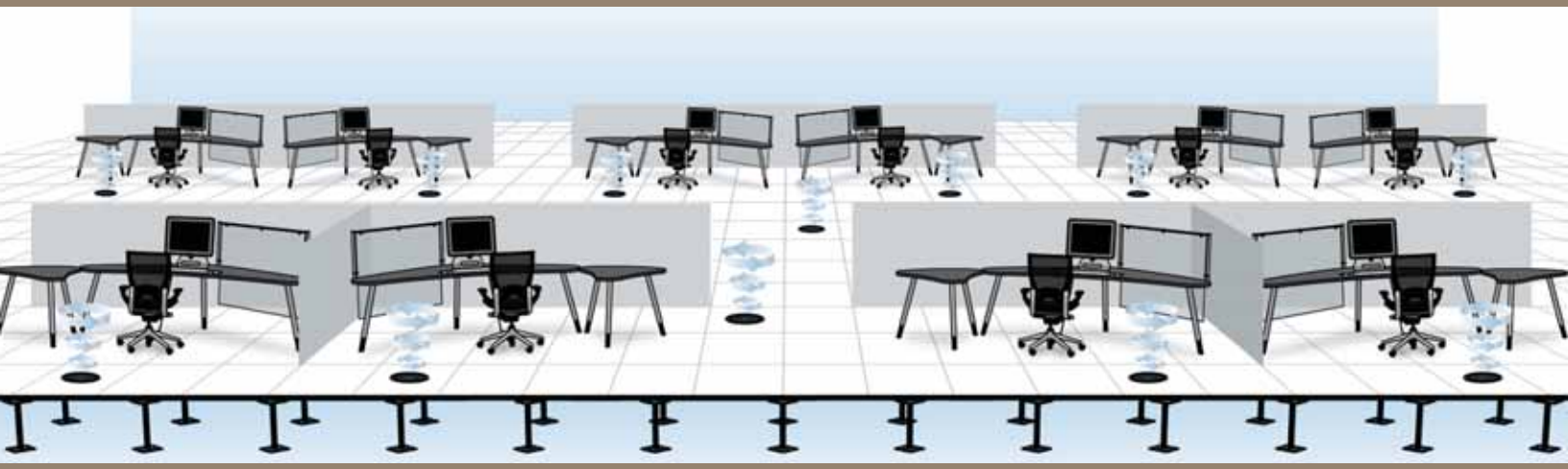
Underfloor Air Systems

Heat generated above the head level by ceiling lights has no bearing on the required airflow because it's ventilated directly through the return vents without raising the temperature in the occupied space.

Flexibility to Accommodate Churn

The International Facility Management Association estimates the average annual churn rate in office buildings is 41% or more. Associated costs are about $32 billion per year. Much of those costs are due to the inflexibility of conventional construction, where ductwork alterations, electrical rewiring and business downtime can cause the costs of workplace change to skyrocket.

But, an underfloor air system adapts easily to change. Simply installing additional air diffusers in the floor panels can accommodate increased cooling requirements. There's no need for expensive, disruptive changes to the supply duct system. Individual occupants can adjust air diffusers within their space to achieve custom comfort that's impossible with overhead systems. The raised flooring also provides easy access to telecommunications and data cabling as well as electrical power. If workstations need to be reconfigured, air diffusers can be relocated by simply moving the appropriate floor panels, bringing conditioned air precisely where it's needed.



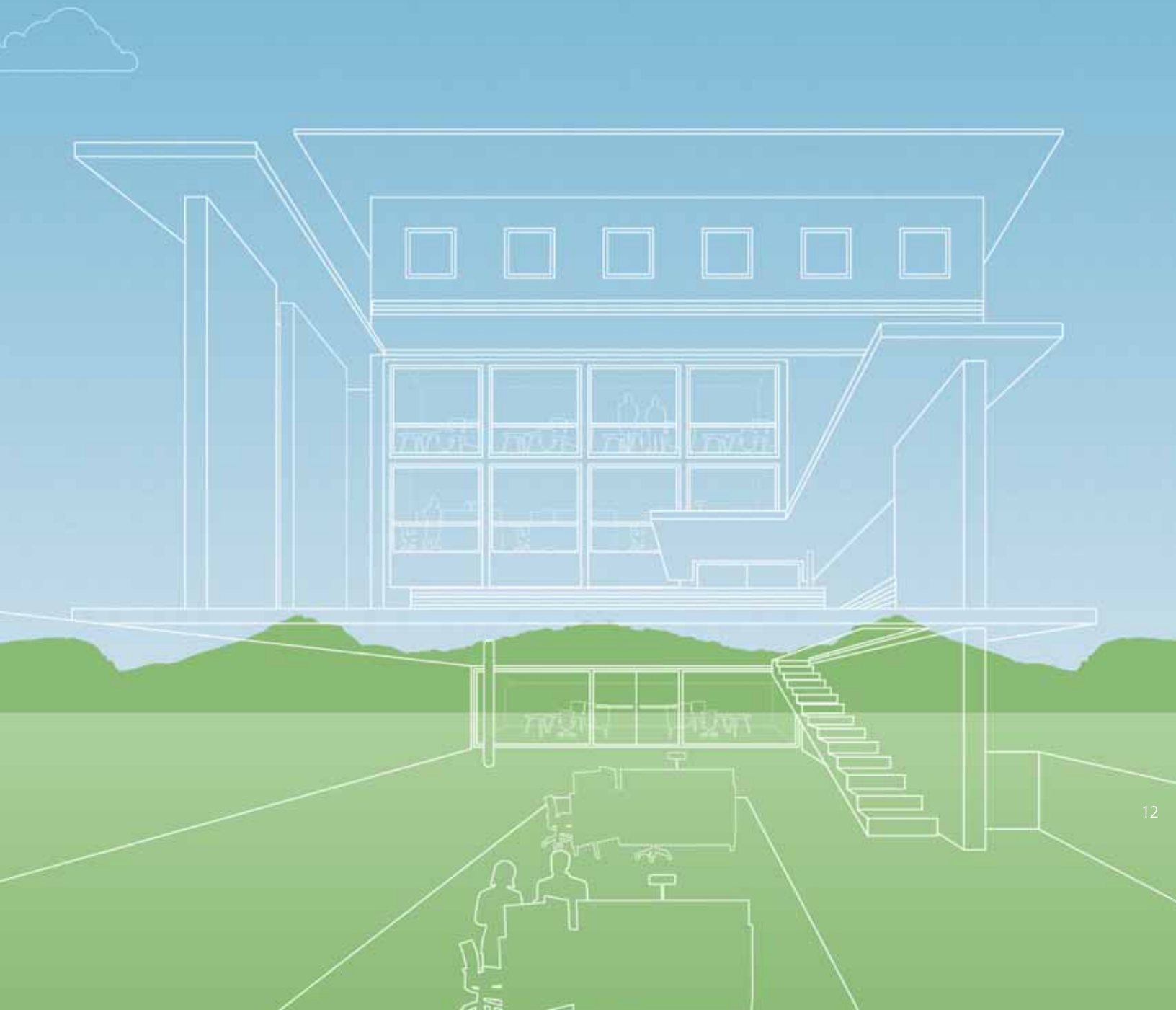
Original Floor Plan

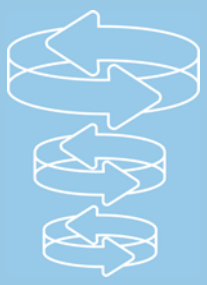
Churned Floor Plan

Better Indoor Air Quality

Studies have shown that improved indoor air quality can mean lower absenteeism and higher productivity. Concentrations of carbon dioxide, airborne bacteria and off-gassing contaminates in spaces served by underfloor air systems are typically much lower than those served by overhead systems.

- Occupants have greater control over the temperature within their space, so complaints about comfort nearly disappear.
- A continual supply of clean, newly conditioned air is introduced directly into the occupied zone where people breathe.
- Conditioned air is not blown down from overhead as it is with conventional systems, so it doesn't pass through (and mix with) the stale air and contaminants that collect near the ceiling.





Where is Underfloor Air Appropriate?

- New construction, or retrofitting an existing space
- Anywhere a raised flooring system is considered or installed to house utilities
- High-density open office areas
- Anywhere individual temperature control is a concern or issue
- Environments with a high rate of churn
- Wherever indoor air quality is a concern
- Facilities with high ceilings
- Single as well as multi-storied buildings
- Everywhere energy savings is important

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