



PO Box 10800, Market Harborough LE16 0HU, UK

www.chilledfood.org

Position Statement

Controlled Environment Agriculture and 'Vertical Farming'

Increasing demands on land space is leading to significant interest in the potential for new ways to farm certain types of fresh produce. In some cases it would seem the only way is up.....

One new method currently attracting attention is Controlled Environment Agriculture (CEA). By enclosing a growing crop in a structure CEA provides protection by reducing exposure to the outdoor environment. This approach can vary - from keeping the crop in simple greenhouses to fully enclosed 'vertical farms'.

The term 'vertical farm' is not formally defined. However, it normally refers to growing operations that are in fully enclosed buildings, with artificial lighting and requiring precise irrigation, temperature, and humidity controls. Height is used to maximise the production per unit area.

The Positives

The potential advantages of CEA *can* include:

- Less crop being lost thanks to the protection from extreme weather.
- Reduced pesticide use as the crops are protected from pest and disease.
- A more consistent crop quality made possible by the ability to control the growing environment.
- Seasons can be extended, with 'home grown' crop replacing imported produce.
- Reduced potential for environmental contamination and the risk of foreign bodies such as insects, particles of soil.
- Less exposure to microbiological risk.
- More economical use of substances involved in crop production including water and fertiliser.
- More local production and a reduction in transport/food miles.

Best Practice will be the Guiding Principle

Chilled Food Association (CFA) champions best practice in the production of fresh produce with respect to use in the chilled food production. It provides guidance for members, and the industry, regarding assurance of the microbiological quality of fresh produce used in ready to eat chilled foods.

The principles outlined in [CFA guidance documents](#) are as relevant for CEA growing systems as for 'traditional', outdoor systems.

Fundamentally, all growing operations – including CEA – should have a Quality Management System (QMS) based on HACCP/risk assessment. The risk assessment will reflect the specific nature of the system.

The Risks

The most intensive growing systems (‘vertical farms’) may pose very different risks to those in fresh produce production. This can be due to:

- Lack of natural light (reducing the suppression of microbial growth).
- Re-circulation of water, which can pose a cross-contamination risk.
- Lack of competitive microflora, creating conditions in which a pathogen could flourish.

The rise in Vertical Farming (VF) has encouraged new operators into the sector. Some of these may not have relevant fresh produce experience. Additionally, businesses using produce from vertical farms may not be aware of, or understand, the type of risks posed by growing produce in enclosed environments.

Areas for Attention

CFA recommends that any risk assessment for a VF operation should pay particular attention to the following:

- Operations should have a quality Management System that is based on HACCP principles. Risk assessment must be based on the *specific* needs of the operation and appropriate mitigation strategies put in place.
- VF growing teams must have an adequate understanding of production system food safety risks and the eventual use of the fresh produce that is being grown.
- Seed can introduce pathogens (plant and human) to a VF operation. Seed is typically field-grown with the expectation that subsequent crops will be grown outdoors. Operators must ensure that seed is fully traceable and verified as free from human pathogens. Alternatively, and where necessary, seed must be treated to minimise risk.
- Media used to grow crops (e.g. peat, coco-fibre, nylon sponges, rockwool, paper, glue-composite plugs etc) must be from known sources and fit for purpose. Certificates of conformity, microbiological testing and/or treatment may be required to prevent contamination of the growing system.
- Water is typically recycled within VF operations. This can have significant environmental and operational benefits, but means that the integrity of the system is highly dependent on both the original water quality and the type of recycling. Vertical farms must understand the source of their water and any risks associated with it, monitor accordingly and treat where necessary to maintain control of human and plant pathogen populations.
- In VF operations - and other hydroponic systems - soil does not help buffer variation in water availability. Vertical farms may need to consider contingency arrangements for any failure in water supply or recirculation systems.
- Personnel should be adequately trained in food safety with particular reference to the nature of the growing system and the eventual use of the fresh produce grown. Hygiene practices will need to reflect the fact that staff are often in close proximity to the crop. The lack of a competitive environment can make contamination events more significant than in an outdoor farm.

- Vertical farms provide a high degree of protection for the growing crop by partially isolating it from the outside environment. However, the isolation is not complete. Consideration must be given to the way in which crop inputs, packaging, operatives etc enter the growing area – and the potential contamination risk.
- VF operations can employ significant infrastructure (e.g. racking, floats, trays, pipes etc.). Because even the most protected operations are not completely closed, contamination can and will occur. The system design needs to facilitate appropriate hygiene practices and standard operating procedures should be used to discipline monitoring and cleaning. The management of *Listeria* risk should be a particular focus, as humid environments and complex growing structures can encourage the survival and growth of *Listeria*.
- Vertical farming operations often use mechanical handling and automation. Handling equipment that is operating close to, or above, growing crops can pose a physical contamination risk. Businesses may need to consider specific monitoring of 'high risk' areas and the use of metal detection to spot foreign bodies in the produce.