Use your eyes for contamination control

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Cross contamination occurs when something is transferred from one item to another and in a food context the recipient is invariably food. We usually talk about contamination and cross contamination in a microbiological sense, but it could also be cross contamination with a chemical or another substance such as glass particles. This article will focus on the microbiological aspects of contamination.

For any contamination to occur there must be a source from which it comes or originates and good examples of these would be people, floors, boots, drains or uncooked products. The contamination then needs to be transferred by a vector such as air, water, hands, food contact surfaces and equipment to the food which is ultimately to be contaminated.

Cross contamination involves an intermediate contamination point. A good example of this would be chicken carcases passing down the processing line and touching a fitting.

If an early bird contaminated this fitting with salmonella or campylobacter, subsequent birds coming down the line could be cross contaminated by coming into contact with this fitting that is contaminated by the micro-organisms that came off the original carcase.

From a management point of view two very basic tasks need to be performed if we are to control contamination – we need to know and control the sources of contamination in our operation and we need to be aware of and control actual and potential vectors that could transfer such contamination on to our product.

If our product goes through an effective decontamination process such as cooking, then this is most pertinent from that point onwards, that is, post cooking. In this context a rigid delineation of the pre- and post cook operations is an essential prerequisite of any control programme.

To assess these we need to carefully observe our operation and identify persistent, or regular, and occasional or accidental opportunities for contamination.

To do this we need to have a mental checklist of sources of contamination to work through. This should include:

The ceiling.

Are there cracks through which dust or water could come from the roof space above? It has been known for accumulated rainwater that was contaminated with vermin and wild bird droppings to contaminate product with the whole range of faecal indicator organisms and pathogens such as salmonella and Listeria monocytogenes.

Can condensation form on the ceiling. This is pertinent because many operations do not clean their ceilings daily and so condensation drips can bring contamination down from the ceiling on to product or equipment below.

Is there flaking paint on the ceiling? Is there equipment on the ceiling such as light fittings on which dust can accumulate.

If there is any draught this could subsequently dislodge that dust with the result that it falls on to whatever is below. Cross beams are a real risk in this context.

Walls.

Walls become a real risk when product is stored against them, for example, in the chiller that contains too much product or when a bottleneck has occurred in production and product is stacked in every available place until the bottleneck is cleared. Ideally in such scenarios product should not be stacked against walls.

Floors.

Floors have two unique characteristics – everything ultimately falls to them and we routinely walk on them. Thus, floors will invariably be very contaminated and so we must ensure that food or anything that will have contact with the food we are producing does not come into contact with the floor either directly or indirectly.

Indirect contact can be via those curtains that are one or two millimetres too long and so have contact with the dirty floor. Any unprotected product passing through such curtains will be contaminated as the curtains trail over the product!

Cooler units.

Cooler units that pass air over wetted vanes are notorious bacterial havens, be it on the wetted vanes or in the drip tray below the vanes. Also, the drainage pipe from the drip tray has a habit of leaking contaminated water. For these reasons such cooler units are not to be recommended for use in high care food production areas.

Where these coolers are used the risks that come with them need to be appreciated. Listeria has known to be blown out of these coolers.

A comprehensive cleaning programme, that invariably involves the engineers giving the cleaners access to the vanes is to be recommended, as is the regular screening of the contents of the drip tray for listeria if this organism is a risk to the type of prod-

Continued on page 12

Table 1. Mean percentage microbial transfer rates for surface vectors (C&C Guideline No. 54, 2007).

Surface vector	Mean transfer rate (%)
Plastic disposable gloves	39.1
Plastic disposable apron	39.5
Polypropylene	40.5
Stainless steel	35.9
Plastic coated textile apron	38.7
Food grade plastic liners	39.5
Plastic conveyor belt	38.7
Bare hands	10.9
Plastic salad crates	38.7
Yellow rubber gloves	39.1
Plastic packaging	38.7

Continued from page 11
ucts you prepare. There is a real risk of these units dripping contaminated water so why not design the room so product can not be stored directly under coolers? This is easily done by the strategic placing of a barrier rail.

1 Equipment.
Any equipment that has direct product contact and is poorly cleaned is a potential source of contamination. If the insides, for example, of a sausage making machine, are not thoroughly cleaned the first batch of sausage mix to go through the machine the next day will 'be the final stage of last night's cleaning process' and, as such, will be contaminated.

Conveyors are notoriously poorly cleaned or, to be more precise, the areas under them. These are often left wet and dirty. If you don't believe me go and lift a few solid conveyors on a Monday morning and take a good sniff! If there is any undesirable smell there will be millions of micro-organisms present.

1 Tools.
Any tool, such as a knife or scoop which is used by the operator, can become a vector of contamination. Obviously these need to be thoroughly clean at the beginning of the day.

However, these will pick up contamination while being used and so a key question has to be how frequently should they be cleaned/sanitised while in use.

1 People.
People can be a source of contamination by, for example, a dripping nose or loose hair but they can also be a vector.

The person who picks something up from the floor and, in so doing, touches the floor with his hand will become a vector from floor to product, as will whatever he picks up if it is reused before being properly sanitised.

Needless to say, toilet hygiene is paramount and we must ensure that the worker does not inadvertently become a vector and bring micro-organisms into the production area from the toilet area.

1 The water supply.
If the water is contaminated it will contaminate any food it is added to or washes. In addition, it will contaminate any equipment that it washes.

However, we should also remember that the means of bringing the water to point of use could become contaminated. A very good example of this is the hose nozzle that has floor contact that will, in effect, make the water a vector for microbial contamination between floor and product.

1 The air.
Dust particles or aerosols in the air can contain microbial contamination. The dust that comes out of the back of a combine harvester is invariably riddled with fungal spores.

So, if your food plant is in a rural area and has a field of standing corn by it, harvest time will see your products' fungal counts rise if the wind is blowing in the wrong direction.

1 Vermin and insects.
These are notorious for inhabiting and foraging in microbiologically dirty environments. If they can then access the food production they will leave contamination wherever they tread and, in effect, be very effective vectors.

Once we have identified sources of contamination and real or potential vectors we should see if they can be eliminated by good practice.

If they can, all well and good. If they can not we need to assess just what the risk is that they represent and, if this is unacceptable, consider how we are going to manage (minimise) it.

To do this we can use microbiological testing. Unfortunately, many operators only test items immediately after cleaning, that is, they are evaluating the effectiveness of the cleaning process – they are not evaluating their risk as a vector. To do this we need to test potential vectors during the working day.

Interestingly, when this is done many materials of vectors are found to have a mean percentage microbial transfer rate of 40%, but the rate of bare hands is a quarter of this (See Table 1).

This observation then fuels the debate on whether or not gloves should be worn bearing in mind that hands 'sweat' inside gloves and the danger of a hole in the glove providing a route for this microbially loaded sweat to move from inside the glove to food product, equipment or work surface is real.

If we look at contamination from a theoretical point of view we need to be aware of four key factors that influence the level of contamination transfer. These are:

1 The actual bacterial load on the source of contamination.
1 The time of exposure to the vector – this is especially important in the case of airborne contamination.
1 The frequency of exposure. In other words can we minimise the number of handling activities?
1 The importance of a vector as a source of contamination. This can be reduced by regular, effective cleaning of the vector.

However, in the real world life is not so simple because other factors come into play such as temperature, the pressure of contact, contact times, accidental contaminations that had not been foreseen, multiple contacts with the same vector, microbial die off and many other factors. Some of these are highlighted in Table 2.

In essence ,much can be done by focusing on the basics. This means know your sources of contamination and the vectors that transfer these to your products and then do all you can to remove these from your work area.

Most importantly, this involves two key attributes, namely, a good set of eyes and spending enough time in the production area to see what is really happening. Contamination control must focus on removing the real risks and the real vectors! n

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Micro-organism	Source and recipient	Transfer rate (%)
Feline calicivirus	Hands to ham Hands to lettuce	46 18
Campylobacter	Stainless steel to chicken	66 (Min. contact) 70 (15 min. contact)
Salmonella enteritidis	Stainless steel to cucumber Stainless steel to chicken	34.8 49 (Min. contact) 32 (15 min. contact)
Salmonella typhimurium	Stainless steel to lettuce	26.9 (wet lettuce) 36.3 (dry lettuce)
Listeria monocytogenes	Conveyor belt to ham and bologna	86.5 (30 secs. contact) 86.5 (60 secs. contact) 86.5 (90 secs. contact)

Table 2. Some interesting differences in microbial transfer rates (J. of Food Protection 66 2759-2763 and 67 1892-1903, Int. Journal of Food Microbiology 85 227-236 and Annual Meeting of IAFP in 2005).