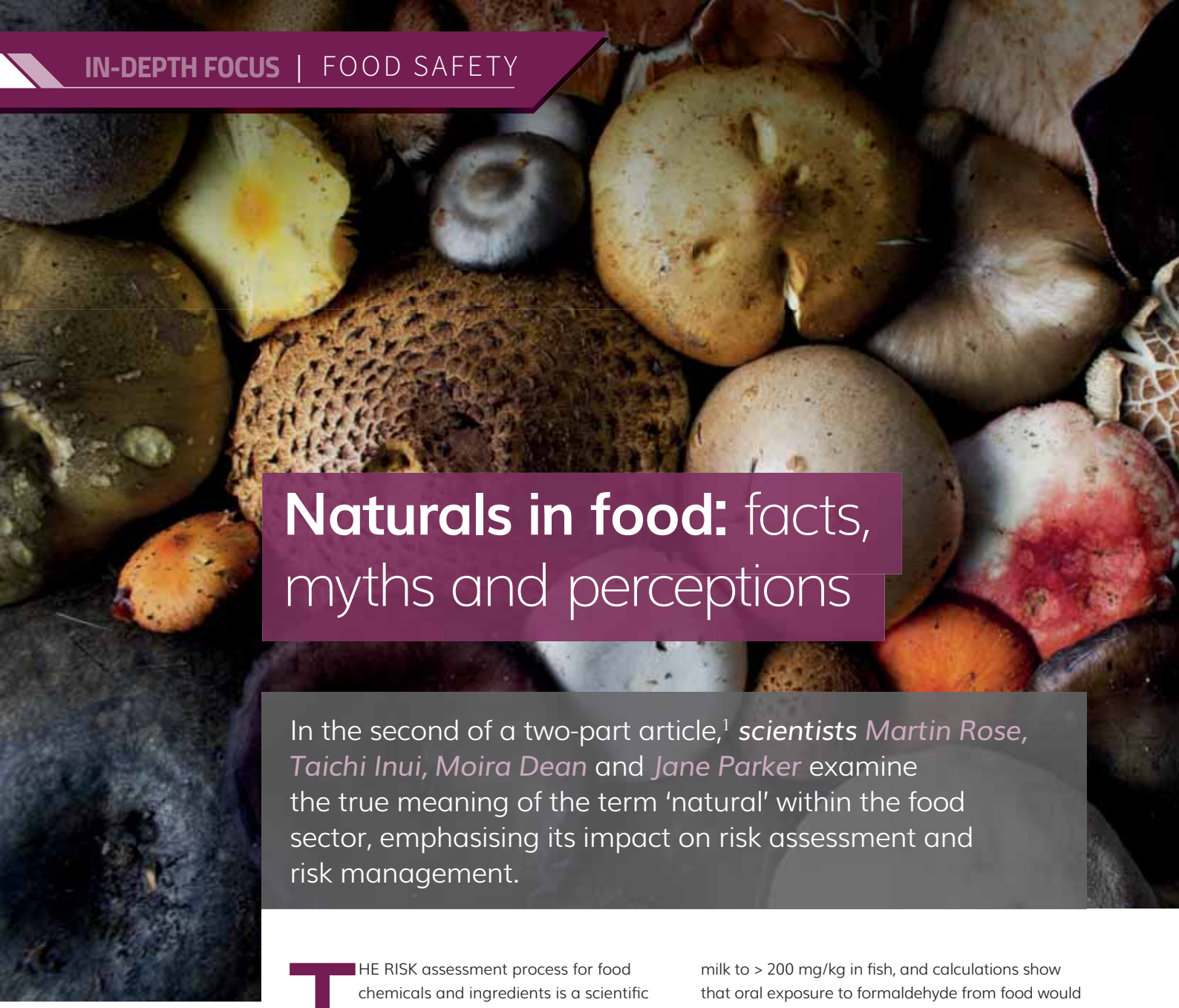
FOOD SAFETY

Scientists Martin Rose, Taichi Inui, Moira Dean and Jane Parker examine the true meaning of the term 'natural' within the food sector, emphasising its impact on risk assessment and risk management.

Arun Chauhan, Founder and Managing Director at Tenet Law, explains how leadership style within an organisation plays a part in preventing and mitigating the risk of food fraud.

Deb Smith, global hygiene specialist, explains why allergen management is vital in any food business.

Dr Lisa O'Connor, Chief Specialist in Biological Safety at the Food Safety Authority of Ireland (FSAI), explores the importance of HACCP procedures.



Naturals in food: facts, myths and perceptions

In the second of a two-part article,[1] ***scientists*** *Martin Rose, Taichi Inui, Moira Dean* and *Jane Parker* examine the true meaning of the term 'natural' within the food sector, emphasising its impact on risk assessment and risk management.

THE RISK assessment process for food chemicals and ingredients is a scientific evaluation of the risk it poses to health as a function of both toxicity and exposure. Risk management uses the risk assessment and combines the evidence with social, political and economic factors to derive limits. A recent ILSI (International Life Sciences Institute) workshop discussed advantages and disadvantages of both hazard- and risk-based approaches to ensuring food safety and concluded that the value of risk-based approaches is becoming increasingly recognised.[2] Whether or not a compound is derived from natural or synthetic processes is irrelevant to risk assessment, but not to risk perception and therefore risk management.

Taking formaldehyde as an example: this is classified as a known human carcinogen both in the EU and the USA. The main concern is inhalation and respiratory cancers, but it is also associated with leukaemia; so there is no dispute that this is a dangerous compound. However, formaldehyde is known to occur naturally and is an essential intermediate in cellular metabolism in mammals and humans. Formaldehyde is found at highly variable concentrations in food, ranging from < 0.1mg/kg in milk to > 200 mg/kg in fish, and calculations show that oral exposure to formaldehyde from food would not normally exceed 100 mg/kg food per person per day, i.e. 1.8 mg/kg bw (body weight) per day for a 70 kg person.[3] It is known that methanol is metabolised to produce formaldehyde, and that methanol is formed from aspartame by enzymes in the digestive system; thus consumption of the sweetener, aspartame, leads to an increased exposure to formaldehyde. However, despite this association with a known carcinogen, it does not make sense to restrict the use of aspartame on this basis since exposure from using aspartame, even with large amounts, results in far lower levels of methanol and formaldehyde than are found from other dietary sources. In fact, the maximum potential change in cellular levels from aspartame at its acceptable daily intake (ADI) is less than the normal variability in these cellular levels. Many of the most toxic compounds that humans are exposed to from their diet come from natural sources and can be considered as natural compounds (***Table 1***).

Although the risk assessment process is the same regardless of the production process, there are some challenges that tend to be associated with 'natural' ingredients. Synthetic, or 'artificial',

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ingredients are often well-defined materials and are usually of high chemical purity. Specifications can be tight, and toxicology studies are conducted on defined materials. Natural ingredients, on the other hand, are generally poorly defined materials, with extracts of varying purity and specifications can be very loose. There can be seasonal or geographical variations that are inherent in the biological nature of the products from which they are derived. Often, it is not certain what was tested or the purity of the product. 'Regulatory creep' can be a problem with the range of quantities used and applications to which natural ingredients are used.

Most traditionally used foods have not been subject to systematic toxicology study but are considered safe to consume as they have a long history of use and lack any evidence of harm. This 'history of safe use' concept has originally been developed for assessment of novel foods and foods derived from genetically modified organisms[4] as a benchmark for comparative safety assessment. To move away from subjective decision making, a multi-criteria decision analysis model was subsequently developed as a comprehensive comparative approach to assess the safety of natural materials.[5] Using all available evidence (concerning history of use and evidence for concern of the natural material or its components), safety decisions can be made more objectively and transparently.

Drivers and challenges when converting to natural

Flavours

Today's consumer demands both natural and sustainable food, so we must question whether they can both be achieved together. Let's consider the world's most popular flavour, vanilla. Madagascar is responsible for 80 percent of the world's vanilla, but in 2017, it faced a devastating cyclone. This saw the price of high quality Madagascan cured vanilla beans overtaking the price of silver and it currently sits at around US$550 per kg (up from US$10 per kg five years ago). An increase in demand, with a decrease in supply and an expensive crop that supports over 80,000 farmers has led to exploitation, corruption and poor-quality produce.

One solution to supplementing the variable, inadequate and expensive supply of extracts of vanilla planifolia is to produce vanillin, the main component of vanilla extract, from other sources. Vanillin can be produced via chemical synthesis, but this is very clearly not natural. However, regulations allow vanillin that has been produced via physical, enzymatic or microbiological processes (which conform to traditional food preparation methods) to be labelled as natural. In the US, natural vanillin can be generated from clove oil or pine tree using eugenol or coniferyl alcohol as starting materials respectively. The EU regulations, perhaps recognising that this may mislead the consumer, do not class this as natural, but vanillin derived from rice bran or corn sugar can be classified as natural in the EU. Thus, by using other natural flavouring ingredients, as defined by EC/1334/2008, it is possible to make a more cost-effective natural vanilla flavouring that still contains vanilla but also contains naturally sourced and isolated aroma molecules such as Vanillin ex Ferulic Acid Natural to 'make the vanilla go further.'

Colours

Colour influences purchasing decisions, signals the quality and safety of the food and influences flavour perception. The classification of natural colours is less regulated than for flavourings, but the Natural Food Colours Association (NATCOL) has

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TABLE 1 Examples of 'natural' toxins

Toxin	Effects	Found in
Algal toxins	Can cause diarrhoea, vomiting, tingling, paralysis	Affects shellfish such as mussels, scallops and oysters
Ciguatoxins	Can cause both central and peripheral neurologic symptoms: vomiting, diarrhoea, numbness of extremities, mouth and lips, reversal of hot and cold sensation, muscle and joint aches	Barracuda, black grouper, dog, snapper, and king mackerel
Cyanogenic glycosides	May result in acute cyanide poisoning and has also been implicated in the etiology of several chronic disease	>2,000 plant species including cassava, sorghum, stone fruits, bamboo roots and almonds
Lectins	May cause severe nausea, diarrhoea and vomiting	Some beans
Furocoumarins	Phototoxic and are problematic mainly after dermal exposure	Effects are reported after consumption of large amounts of vegetables
Mycotoxins	Symptoms of severe illness and even death can appear quickly after eating highly contaminated food, chronic mycotoxin exposure can induce cancers and immune deficiency	Numerous foodstuffs such as cereals, dried fruits, nuts and spices
Various components found in fungi	Can induce vomiting, diarrhoea, confusion, visual disturbances, salivation and hallucinations. Onset 6-24 hours after eating; fatal poisoning associated with delayed onset of very severe symptoms affecting liver, kidney and nervous systems	Poisonous mushrooms
Solanines and chaconine (glycoalkaloids)	Effects on the nervous system included increased heart, pulse, and respiratory rates, sedation and coma	Sprouts and green parts of tomatoes, potatoes, and eggplants
Pyrrolizidine alkaloids	Some are acutely toxic but the main concern is the DNA-damaging potential of certain PAs	Tea, herbal infusions and food supplements

defined a classification of natural colours related to 'degree of naturality' (***Table 2***). Again, food regulations are not aligned with consumer demand, nor are they aligned globally. Spirulina extract that comes from a blue-green algae is classified as an 'additive' in the US, but a 'food' in the EU, while pigments like chlorophyll are allowed as a colour additive in the EU, but not in US. The major challenges, particularly when converting to natural colours, are that natural colours are more susceptible to interactions with other components of the food matrix, inorganic salts, light, oxygen, processing and especially pH. Anthocyanins change from red to blue over a pH range of 3-6, and heat treatment or the addition of vitamins can cause browning. Colours from natural sources are more expensive than their synthetic alternatives, but companies are focusing on minimising the agricultural footprint and optimising extraction procedures, formulation and applications.

Pet care products

As the use of the term 'natural' has expanded in human food, so it has been adopted and applied to the world of pet food too – with one significant difference. In the USA and EU, the term 'natural' is defined either by regulation or Code of Practice. In practice, at least in Europe, few, if any pet foods are likely to be able to describe themselves as natural but many can, and do, claim to be made with natural ingredients. Of course, this doesn't necessarily mean that they are better than foods not making such a claim, since main meal pet foods must contain all the daily nutrients that a pet needs; so 'natural' isn't necessarily better in nutrition terms. Neither does it mean the products are safer – any European pet food containing animal products must be processed to minimum legal standards to ensure that they

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PROFESSOR MOIRA DEAN'S research group focuses on studying the 'head, heart and hands' (perceptions, attitudes and behaviours) of actors along the food supply chain to explore food security challenges in three main areas: global food integrity, nutrition and health, and how we'll feed the world's growing population in a sustainable, cost-effective and environmentally-friendly way.

TABLE 2 Classification of 'natural' colours

Colour category		
Artificial colours	Increasing 'naturality'	Synthesised from chemicals e.g. tartrazine, brilliant blue
Artificial but nature identical colours		Synthesised from chemicals but are chemically identical to those found in nature
Nature-derived colours		Extracted from natural source, but chemically modified eg. Stabilized with Cu – or laked with aluminium
Natural colours		Extracted from natural source e.g. turmeric, anthocyanins, chlorophylls, carotenes, calcium carbonate
Colouring foods		Juices and concentrates e.g black carrot, orange carrot, spirulina, sweet potato, hibiscus

are safe for owners to handle and pets to consume. Increasingly, 'natural' has become shorthand for a product sector within pet food, that encompasses other terms and claims, such as organic; exclusion diets (i.e. made without wheat); ancestral products and ancient grains. This approach, together with advances in innovation and technology, such as the introduction of chilled pet foods in Europe, offers both challenge and opportunity to manufacturers wishing to expand into this growing area.

Conclusions

Terms such as 'natural' have an increasing importance to consumers and therefore to the food industry. This is reflected not only in terms of product development and marketing but is also a key factor for innovative food technologies. Whilst 'natural' is important for the consumer, it is part of a balance of conflicting interests. The consumer wants products that are unprocessed and natural – but at the same time are convenient, affordable and quick to cook. This presents a challenge for industry to implement production processes, ingredients, packaging and marketing activities so that the product may be perceived as natural, with similarities to traditional food, yet with long shelf life and convenience.

ACKNOWLEDGEMENT

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To find out more about the Royal Society of Chemistry (RSC), and in particular the Food and Toxicology Interest Groups, see https://www.rsc.org/Membership/Networ-ing/InterestGroups/Food/index.asp and http://www.rsc.org/Membership/Networking/InterestGroups/Toxicology/index.asp

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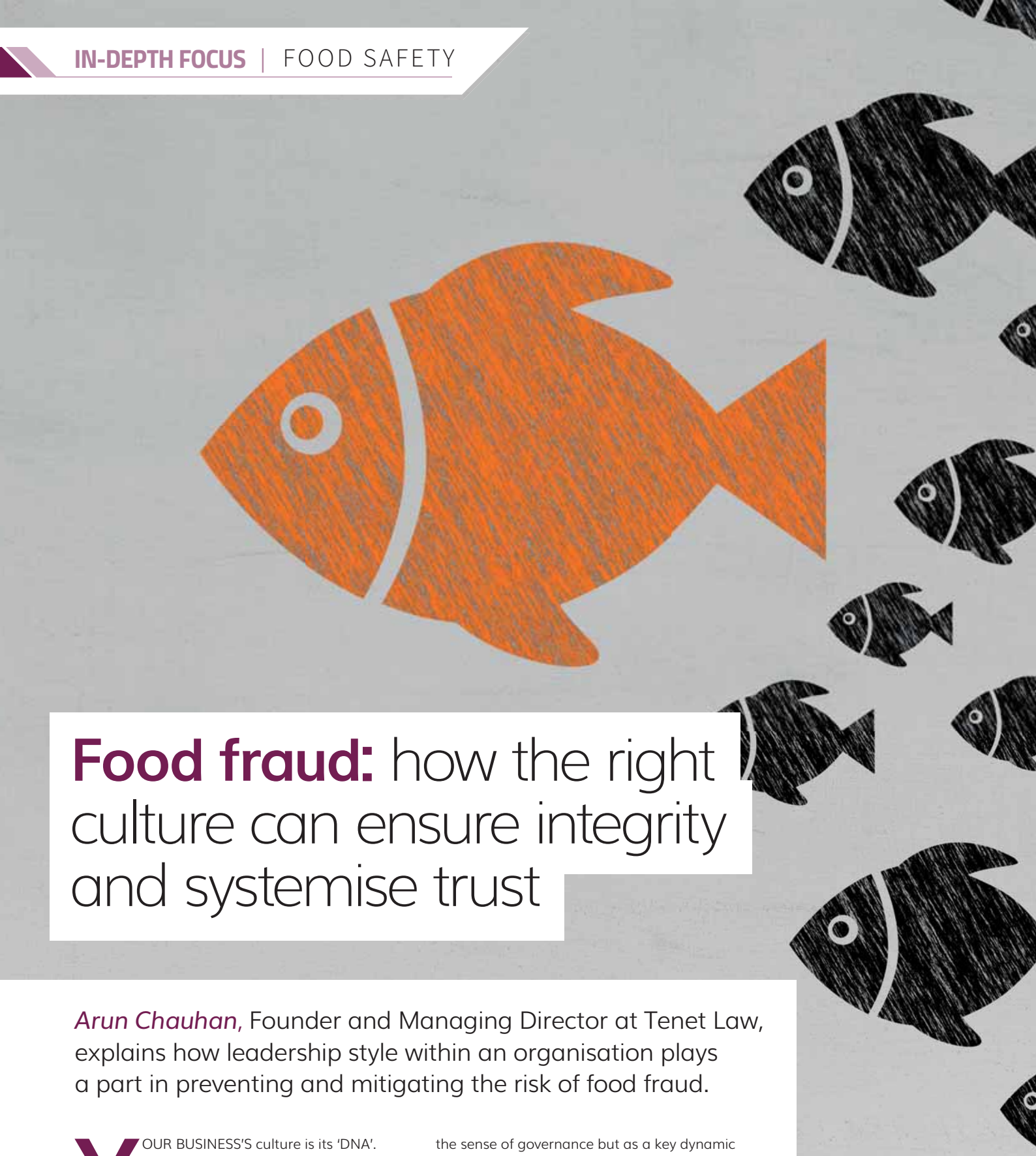


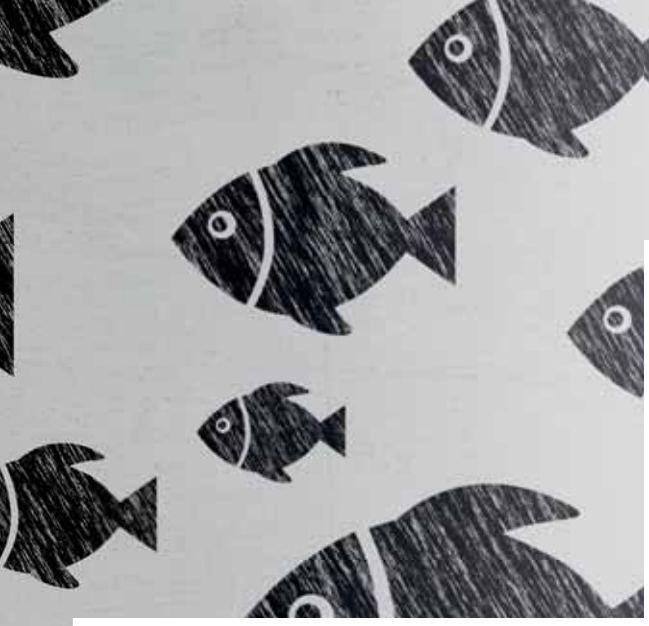
Food fraud: how the right culture can ensure integrity and systemise trust

Arun Chauhan, Founder and Managing Director at Tenet Law, explains how leadership style within an organisation plays a part in preventing and mitigating the risk of food fraud.

YOUR BUSINESS'S culture is its 'DNA'. It represents the unique way it operates; 'How we do things around here'. It's what differentiates your business and defines its values. Leaders set the tone for this culture and, in this sense, leadership is the dynamic way that each organisation is led by either an individual or group (eg board or management).

Dishonesty within any business, be it internal or external, can result from many factors. One factor that is often overlooked is leadership – not in the sense of governance but as a key dynamic impacting culture and therefore engagement. Engagement is key. Failing to instil the right culture can lead to heightened risk of employee disenchantment, which can present itself in many ways – from simple acts of ignorance through to dishonest activity.

It is often cited that pressure initiates symptoms that lead to dishonest behaviour. Pressure can encourage employees to act dishonestly as they use it to rationalise their conduct. That is the traditional fraud triangle.[1]



However, in all sectors, we overlook how pressure is associated with fraud and is directly attributable to leadership.

The influence of leadership

Every leader wants to be the best and achieve their corporate objectives. Problems start when corporate objectives cascade down to the individual without an understanding of the challenges upon the individuals to meet those objectives. Self-protection can come into play and leaders often pass on the pressure to their teams, which may prompt them to act in a manner that invites risk to the business.

A leader increases the risk of bad behaviour in the following ways:

- Condoning an unethical approach
- Encouraging team members to cut corners
- Turning a blind eye to bending the rules to meet unrealistic targets
- Not recognising the pressure placed on employees due to absent leadership or too many demands.

Each of these can lead an employee to become disenchanted and act out of character. The cauldron of pressure created by leadership in the workplace is proven to influence good people to do bad things.

Poor leadership can create a toxic environment, rich with stress, poorly-aligned performance incentives and everyday tolerance of wrong-doings. If organisations don't strive for zero-tolerance of bad conduct, they allow for a maximum-tolerance for small wrongs.

There are three leadership types that actively make an otherwise conscientious culture prone to fraudulent behaviours: the autocratic leader, the metrics-driven leader (the clock-watcher) and the absent leader.[2]

Leadership style closely correlates with employee behaviour. When the culture created by a leader is disconnected from their team or the mission of an organisation, employees may well become disengaged – meaning they'll only be coming to work for the money and certainly aren't candidate whistle-blowers.

This disengagement coupled with high-pressured, highly-conflicting working environments can lead to employees being unable to make morally sound decisions. All of us, when emotionally drained, are susceptible to poor decision making. Leaders can be guilty of creating an environment that influences good people to lose their way – unable to find 'true north' on their moral compass when drained, which results in bad conduct, or dishonesty.

Our moral compass is not fixed. It can change path if the environment created by our leadership influences it in such a way.

Food fraud

From unintentional mislabelling of products[3] to the nationwide horsemeat scandal[4] and international honey laundering practice[5], food fraud is rife across the globe with few signs that it's abating.

Since bartering and trade began, fraud has been present. The food sector now comprises complex supply chains linking myriad suppliers, spread over

ABOVE: Tenet's Alternative Fraud Triangle

several countries, each with different cultural norms that combine to create a more heightened risk profile than many other sectors.

This increased risk profile, coupled with the potentially devastating impact – both in terms of financial and reputational loss – can result in highly-esteemed food brands falling prey to the smallest of mistakes.

The only safeguard against this is ensuring all of your fraud defences are working; starting with your team.

People in an organisation protect against risk of fraud when they buy into their organisation's standards and compliance processes.

As profit margins in the food industry are typically much smaller than in other sectors, high performance targets can be difficult to achieve and sustain. Any financial loss incurred can be crippling to overall business performance and shareholder confidence.

This means, when tackling financial crime – a key risk to the integrity of your supply chain – many food businesses can be primarily concerned with combatting fraud due to regulatory or financial sanctions, as opposed to being purely driven to combat financial crime itself. This is a question of being a grown-up company demonstrating corporate maturity.

In his Model of Maturity and Culture,[6] David Jackman depicts how values-led businesses follow the spirit of the law, not just the letter – demonstrating corporate maturity by partnering

EXPERTVIEW

Nina Spencer
Commercial Manager, Premier Analytical Services (PAS)

"The risk management system is only as strong as its weakest link"

The importance of risk assessment in food safety

Effective risk assessment is not only essential for achieving robust food safety management strategies but also underpins the legal requirement as laid out in food safety regulations, whereby food businesses must use a system based on HACCP principles to identify and control all relevant food safety concerns.

Risk assessment requires a thorough knowledge of the product and what makes it what it is; including ingredients, process, process intermediates, processing environment, distribution, storage conditions and consumer use.

This information is then assessed against a solid knowledge base of hazards and how to mitigate the risk of their occurrence.

Whilst there are financial considerations to maintaining and developing this required level of knowledge, the financial impact of not doing so can mean the difference between a viable and non-viable business as failure to perform effective risk assessment, thereby preventing effect risk management, potentially jeopardises the safety of the consumers exposed to those products.

It is also essential to maintain a suitable level of knowledge to assess the fitness for purpose of risk assessments performed by suppliers into a business or third-party manufacturer, as the end product relies on effective risk management throughout the supply chain. The risk management system is only as strong as its weakest link.

The risk assessment process must identify and inform from the initial risk assessors to all stakeholders involved in the manufacture – and, importantly, the evolution – of the product and process. It should lead to a clear and concise risk assessment profile for each process and product type, which is understood and serves to underpin all controls used during manufacture as well as provide a point of reference for review when dealing with issues or considering managing change.

If correctly performed, it can avoid costly mistakes, ensure customer safety, enhance business reputation and enable cost effective control, avoiding unnecessary costs in inappropriate validation and verification exercises.

PAS recognise the importance of effective risk assessment and communication and can assist with this process by investing in the necessary knowledge and making it accessible where businesses require it. This enables cost effective solutions to help businesses deliver safe products to market. ■

with regulatory compliance bodies to ensure product integrity. However, those primarily fearing regulatory enforcement, will work only to meet the minimum standards, thus leading to a weaker corporate culture that views compliance as a cost to the business.

Trust is the by-product of value-led businesses (and their leadership). High trust typically demonstrates higher compliance standards, which, in the food sector, ultimately protects the consumer and builds brand collateral.

If you're placing profit ahead of all other business factors – including your team – it can promote a culture at high risk of demotivation and disenchantment.

How well do you know your supply chain?

Only science can give you full confidence in the ingredients of each product in your supply chain. Technology is now key to food integrity – be it DNA or other tests.

For example, if you're buying fresh fish from a fishmonger, you can be confident you're purchasing genuine, fresh fish. Frozen blocks of fish bring uncertainty to the fish's authenticity; a factor that's even more in doubt when buying fish paste or powder.

If your supply chain places profit ahead of integrity (albeit without realising it) or is disenfranchised by the way they're treated, you may fall victim to 'tricks of the trade' practices.

Leaders affect the financial and other commercial pressures on suppliers, which can lead to product quality and brand reputation being compromised.

DNA testing is the only sure path to knowing with certainty that ingredients are genuine. However, this takes time and can be costly as well as indicate mistrust amongst your supply chain. In turn, this can project poor leadership, profile a negative corporate culture and prompt disenchantment – all factors that contribute to a high-risk environment for fraud (the act you were seeking to prevent in the first instance).

Instead, preventing fraud is about systemising trust and placing integrity first.

Ensuring integrity in your supply chain

"What's the worst that could happen if we fall victim to fraud?" is the best question to address when attempting to identify the risk of fraud and mitigate it through leadership, culture and tackling disenchantment.

These principles, when combined, are about creating a culture with high levels of trust

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ABOVE: The international honey laundering scandal shows that food fraud is rife across the globe

Protecting your business: a summary

Food brands flourish or wither on the strength of their leadership and this maxim is particularly pertinent to their susceptibility to fraud.

Leaders set the moral compass and the tone, which guides what their teams believe and how they behave.

Responsibility, commitment, honesty, and loyalty are just words until a leader shows they're real in their deeds when faced with a judgment call.

The first stage of preventing fraud is to think about it differently – see your company culture from each employee's point-of-view – is it positive? Or does something need to change? Our people are our eyes and ears; engage with them and they will engage with you. This ethos is at the heart of businesses that combat fraud more effectively than others.

Preventing and mitigating the risk of food fraud is all about creating a culture of information sharing and whistle-blowing throughout the entire industry.

and integrity and zero tolerance for dishonest behaviour. This, in turn, will reduce the risk of fraud within the food supply chain. A positive culture such as this will project throughout the business.

A global issue

Food fraud is a global issue, as highlighted by the honey laundering scandal.[7] Your food supply chain is global – across several different jurisdictions with different regulatory standards.

As a nation, the UK has relatively high food standards with the food supply chain being led by retailers. In Europe, the market is led by manufacturers.

The Italian agricultural market is worth an estimated €7 billion[8] with a significant portion controlled by organised crime groups.

Supply chains call for complete transparency to assure their global integrity across all jurisdictions – regardless of various regulatory standards. To achieve this, it's vital to evaluate the culture of your whole supply chain, determining how it acts at each stage. As a result, you'll be able to ascertain if your supply chain is:

1. Delivering a product of consistent world-class quality
2. Meeting minimum regulatory standards to ensure compliance while maximising profit margins in each jurisdiction
3. Placing profit ahead of all other factors – eg, cutting corners to improve margins with little regard for moral or legal consequences.

SIX KEY PRINCIPLES

Chris Elliott, School of Biological Sciences professor at Queen's University Belfast, cites six principles guiding high-integrity food supply chains[9]:

1. **Safe food:** Improved education and innovative food packaging can reduce levels of food-borne illnesses.
2. **Authentic food:** There are myriad opportunities for food and drink fraud within the global food supply chain. Ensuring authenticity will prevent loss of trust.
3. **Nutritious food:** Detailing micro-nutritional content of food.
4. **Sustainable systems:** The UK has a pivotal role to play in delivering sustainable agriculture by increasing crop yields without impacting nutritional content, reducing food waste through better storage.
5. **Highest ethical standards:** Continuing to lift standards.
6. **Respect:** For both the environment and people in the food industry.

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Allergen management is vital in any food business, but optimal functioning requires it to be seamlessly integrated into a site's overall food safety management system. Potential consequences of ignoring this, or getting it wrong, range from causing a consumer discomfort to causing their death. *Deb Smith*, global hygiene specialist, explains more.

Allergen control: why is it important?

Allergies of all kinds are on the increase. It is estimated that one in 50 children in the UK has a nut allergy. Peanut allergy cases have tripled in the last decade and hospital admissions related to allergic reactions have increased by 33 percent in the last five years. Every year in the UK there are around 10 deaths as a result of food allergies, with the under 25s being at greatest risk.

Consequently, it is essential that all those involved with the production of food know what the allergens are, why they need to be controlled, and how this is best achieved.

Allergen control: legal and global food safety standard requirements

There are currently 14 allergens listed by the EU, listed as follows:

- Milk
- Eggs
- Cereals containing gluten (wheat, rye and barley)
- Fish
- Crustaceans
- Molluscs
- Tree nuts
- Soy (soya)
- Peanuts
- Sesame
- Lupin
- Mustard
- Celery
- Sulphur dioxide (sulphites).

If your site produces foods that contains any of these allergens (allergenic foods) and/or foods that don't (non-allergenic foods), you have a legal responsibility to ensure that those that do are labelled properly, and that those that don't are allergen free (or are labelled appropriately).

In addition to the legal requirement for control of allergens, if you are working to the BRCv8 safety standard, this contains specific requirements regarding 'Management of Allergens'.

Requirement 5.3:

'The site shall have a system for the management of allergenic materials, which minimises the risk of allergen contamination of products and meets legal requirements for labelling in the country of sale.'

Section 5.3.8:

'Use of validated cleaning methods and *equipment* that are *identifiable* and *specified for use* with allergenic material, and that are of single use or can be *effectively cleaned* after use.'

Allergen control: how can it be achieved?

Ideally, on a site that produces both foods that contain allergens and foods that don't, production of foods that are allergenic would be carried out in a physically separated area, using dedicated equipment, facilities and personnel. This approach would minimise the risk of allergen cross-contamination to the non-allergenic products.

However, this situation is very rare and, more often, allergenic food production is carried out on a separate line that is spatially segregated from non-allergenic food production; or on the same line with a deep clean of the equipment between allergenic and non-allergenic food production.

In all cases, the use of colour coding can help to further minimise the risk of allergen cross-contamination and aid compliance with global food safety standards.

Use of equipment that is *'...identifiable and specified for use with allergenic material'*

Use of colour-coded cleaning equipment and utensils provides a visual check that only equipment colour coded for use with that allergen is used.

The more unusual and distinctive colours – such as orange, pink, purple and now lime – are often chosen for use with allergens.

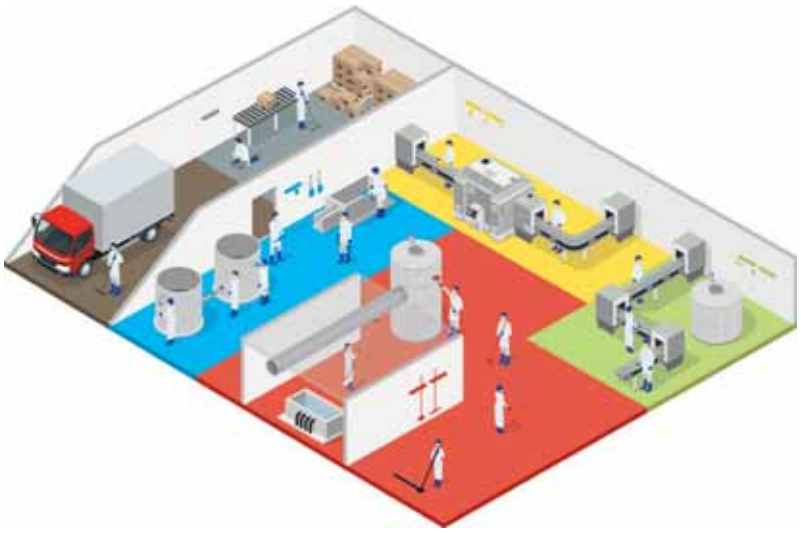
Additionally, equipment can be colour coded at a secondary level using coloured silicone rubber bands. These rubber bands can also be used to identify vacuum attachments used for different purposes.

Segregation of allergen production areas by colour provides an easy visual check that only tools

ABOVE: Equipment can be colour coded at a secondary level using coloured silicone rubber bands

BELOW: Equipment used for each different allergen should be stored on its own separate colour-coordinated rack or board

FIGURE 1



RIGHT: Segregation of allergen production areas by colour provides an easy visual check that only tools and utensils colour-coded for use in that area are to be used

and utensils colour coded for use in that area are to be used; for example, the use of lime equipment only in the lime 'allergen' production area shown in ***Figure 1***.

To minimise the risk of cross-contamination further, cleaning tools and utensils used for allergens should be stored on colour-coded wall racks or shadow boards; for example, if lime-coloured equipment is used with the allergen sesame, they should be stored on a lime-coloured tool rack.

Equipment used for each different allergen should be stored on its own separate colour-coordinated rack or board, and no tool used for allergenic food production/cleaning should be stored on the same board as those used for non-allergenic food production/cleaning.

REGULATION (EU) NO 1169/2011

This regulation on the provision of food information to consumers, provides the following:

- **Clearer and harmonised presentation of allergens (for example, soy, nuts, gluten and lactose) for prepacked foods (emphasis by font, style or background colour) in the list of ingredients**
- **Mandatory allergen information for non-prepacked food, including in restaurants and cafes.**

ARTICLE 14 OF REGULATION (EC) NO 178/2002

This article on the general principles of food law sets out European food safety requirements. It includes that food must not be placed on the market if it is unsafe, for example:

- **Injurious to health**
- **Unfit for human consumption.**

This can include food that is allergenic and not labelled properly and food that is non-allergenic but is unintentionally contaminated with an allergen.

Use of equipment that *'can be effectively cleaned after use'*

Equipment that can be effectively cleaned after use incorporates hygienic design. Both the BRC and FSSC 22000 specify the requirement to use cleaning equipment and tools of hygienic design.

BRCv8

4.11.6. 'cleaning equipment should be hygienically designed...'

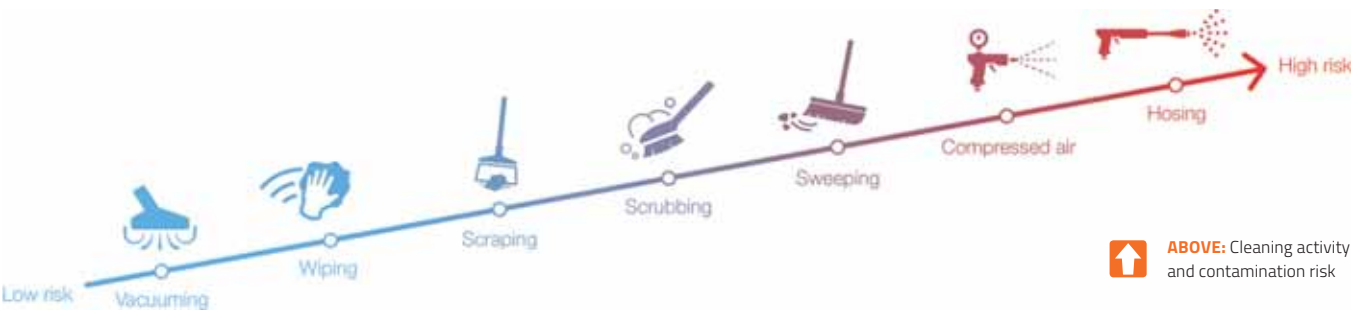
FSSC 22000: ISO/TS 22002-1:2009

11.2 Cleaning and sanitising agents and tools: 'Tools and equipment shall be of hygienic design...'

Good hygienic design principles have been specified by the European Hygienic Engineering Design Group.[1] This document is available as a free download.[2]

They specify that equipment should:

- Have no sharp internal angles
- Have all areas accessible for easy cleaning and disinfection; i.e., avoid deep recesses, nooks and crannies
- Be of one-piece construction, or quickly and easily dismantled/re-assembled



ABOVE: Cleaning activity and contamination risk

- Have a smooth surface finish
- Be made of appropriate materials; i.e., non-absorbent, food-contact compliant.

It is also important to clean equipment prior to first use. Un-wrapped, boxed or even bagged equipment may be contaminated with allergen residues from being handled during production, packing, transport and storage.

Furthermore, all cleaning activities spread contamination, so the cleaning equipment and methods chosen to control allergens can play a key role in minimising cross-contamination:

- Choose cleaning equipment and methods that maximise contamination removal and minimise its spread
- Don't clean, or at least minimise cleaning, during production
- Clean things as far away as possible from open product (spacial segregation)
- Clean in physically-segregated areas to protect product from splashes etc, (separate cleaning rooms/screens)
- Allow time for aerosols and particles generated by cleaning activities to settle before cleaning food contact surfaces
- Have dedicated allergen spill kits in the same colour as the allergen cleaning tools and utensils.

Further guidence on the use of colour coding for food safety, the selection of hygienically-designed brushware and the maintenance of cleaning equipment and utensils can be found on the Vikan website.[3]

TOP 10 TIPS FOR ALLERGEN CONTROL

1. **Understand why it is important**
2. **Choose equipment of good hygienic design**
3. **Clean equipment before first use**
4. **Use colour-coded equipment for allergen use**
5. **Use colour-coded segregation of areas used for allergenic food production**
6. **Use methods and equipment that maximise cleaning and minimise spread of contamination**
7. **Store tools used for allergen cleaning separately and appropriately**
8. **Regularly inspect, clean and replace your cleaning tools**
9. **Have dedicated allergen spill kits**
10. **Train your staff in allergen control.**

REFERENCES

1. EHEDG, 2018
2. www.ehedg.org/guidelines/free-documents/
3. www.vikan.com/uk/knowledge-centre/download-centre

HACCP and your **food business**

Dr Lisa O'Connor, Chief Specialist in Biological Safety at the Food Safety Authority of Ireland (FSAI), explains the term HACCP (Hazard Analysis and Critical Control Point), which can confuse people but essentially refers to procedures that must be in place to ensure the food you produce is safe to eat.

> *"In Europe it is a legal requirement for all food businesses to have a food safety management system based on the principles of HACCP"*

A FOOD SAFETY management system based on the principles of HACCP is a systematic approach to identifying and controlling hazards, whether microbiological, chemical or physical, that could pose a threat to the production of safe food. In simple terms, it involves identifying what could go wrong in a food business, planning how to prevent it and checking that the plan isxbeing followed.

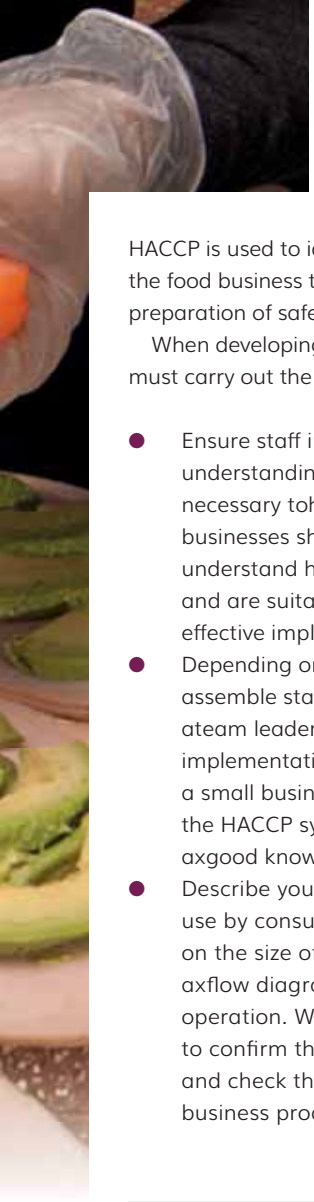
In Europe it is a legal requirement for all food businesses to have a food safety management system based on the principles of HACCP. Meetingxthis requirement can be achieved in several ways, depending on what best suits your food business. You may:

- Develop a HACCP system by applying thexprinciples of HACCP
- Follow a relevant industry guide to good practice, recognised by the national Authority, in which the HACCP principles have been applied in its development.

In the case of a food business undertaking simple food operations (e.g. service of pre-packaged food) the correct implementation of the legal hygiene requirements (sometimes referred to as prerequisites) may be enough to control all hazards. Such prerequisites include:

- Cleaning and sanitation
- Maintenance
- Personnel hygiene and training
- Pest control
- Plant and equipment
- Premises and structure
- Services (compressed air, ice, steam, ventilation, water, etc.)
- Storage, distribution and transport
- Waste management
- Zoning (physical separation of activities to prevent potential food contamination).

The foundation of a food safety management system is having effective standards of good hygiene practice (prerequisites) in place. In general, most hazards are controlled by the prerequisites.



HACCP is used to identify and control key steps in the food business that are critical in ensuring the preparation of safe food.

When developing a HACCP system, businesses must carry out the following:

- Ensure staff involved have a basic understanding of HACCP. If it is necessary tohire a HACCP consultant, businesses should ensure staff understand how the system works and are suitably trained toxensure effective implementation.
- Depending on the size of the business, assemble staff into a team, with ateam leader to lead the design and implementation of HACCP. In the case of a small business, one person may develop the HACCP system. The team should have axgood knowledge of your business.
- Describe your product(s) and the intended use by consumers and then, depending on the size of the business, draw up axflow diagram to show each step of your operation. Walk through your operation to confirm that the flow diagram is correct and check that it covers all the foods your business produces.

There are seven principles of HACCP. A food safety management system based on these seven principles will enable hazards to be identified and controlled before they threaten the safety of your food and the health of your customers.

1. Identify the hazards

Consider each step (e.g. purchasing, delivery, storage, preparation, cooking, chilling, etc.) in your operation and identify what can go wrong; e.g. *Salmonella* in a cooked chicken product due to cross contamination with raw meat (biological hazard), contamination of uncovered food with detergent (chemical hazard), or a piece of broken glass falling into uncovered food (physical hazard). In recent years, due to the requirement to provide accurate information on food allergens for both pre-packaged food and food sold loose, allergens are being treated by businesses as a fourth hazard category, which they need to identify and control.

2. Determine the critical control points (CCPs)

Once hazards have been identified, you must ensure that they are adequately controlled. As aforementioned, most hazards are controlled by ensuring that you are operating an effective prerequisite programme, i.e. good hygiene practices.

Impartiality and independence of ISO 17025 accredited laboratories

The Upscience laboratory has belonged to the ADM group since July 2018. Sometimes customers or some raw material suppliers of our group ask us questions about our impartiality and independence. Some competitors argue the fact that we are not independent enough and that results of our analyses could be communicated to our managers or shareholders. Chapter 4 of the ISO 17025 standard requires lab managers to organise and manage the production with complete impartiality and independence.

First of all let's say that this requirement has always been present in our lab networks and since the beginning of its history in 1964 access to our lab, which at that time was inside our factories, has been subject to formal authorisation and all data has been stored in special and closed rooms. Plant production managers have always been considered as customers for our labs and there was no direct reporting line between the staff in charge of the lab analyses and the plant production managers.

The very essence of Upscience was, and is still, to provide a result that is technically the most representative and ethical. The commitment of Upscience's management is also key; we clearly give our technicians and engineers the possibility of alerting our managers if they consider that the quality of their results are being subject to external or internal pressures.

We belong to a large group and we (all the staff) have some daily relationships with members of our group. That is what ISO 17025 calls, 'familiarity', this means that, the risk resulting from Upscience or its staff being too familiar or overconfident rather than seeking confidentiality with some members of the group is high. That's why in the organisation, we promote a complete anonymisation of the samples and as soon as the samples arrive in our lab they just become completely anonymous. Samples become just numbers. ■

EXPERTVIEW

Claude Charreteur
Business Developer
for Upscience, Neovia

"The very essence of Upscience was, and is still, to provide a result that is technically the most representative and ethical"

ABOUT THE AUTHOR

DR LISA O'CONNOR has been working with the Food Safety Authority of Ireland (FSAI) for over 20 years in various roles. She currently leads the team responsible for producing guidance on microbial food safety issues, conducting microbial risk assessments and providing scientific support to the FSAI's Biological Safety Sub-committee. She has been involved in producing national guidance on HACCP, negotiating European guidance and in coordinating a national strategy to improve HACCP compliance levels.

A critical control point (commonly referred to as 'CCP') is a step where a control procedure must be applied to prevent a food safety hazard occurring or reduce it to a safe level. It is the last chance to control a hazard before the food is sold. For example, thorough cooking of beef burgers will kill harmful bacteria that may be present in the centre or thickest part of the burger.

3. Establish critical limit(s)

Set limits to enable you to identify when a CCP is out of control; e.g. the temperature at the centre of a beef burger following cooking must reach axminimum of 70°C for two minutes, or equivalent (i.e., 75°C instantaneously).

4. Establish a system to monitor control of the CCP

When CCPs and critical limits have been identified it is important to establish a way to monitor and record what is happening at each CCP. Typically, monitoring will involve measuring parameters such as temperature and time. However, the method and frequency with which you monitor will depend on the size and nature of your food business.

5. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control

When monitoring indicates that a CCP is not under control, corrective action must be taken (e.g. the temperature of refrigerated cooked meat rises to >10°C for over 24 hours due to a technical fault in the refrigerator). The cooked meat is disposed of and the refrigerator is repaired to maintain new cooked meat supplies at the correct temperature.

6. Establish procedures for verification to confirm the HACCP system is working effectively

Review the system periodically and whenever you make changes to your operation; for instance, when replacing an oven verify that the time/temperature settings in the new oven achieve the minimum safe cooking temperature for a particular dish by probing the food.

7. Establish documentation concerning all procedures and records appropriate to these principles and their application

To ensure successful implementation of a HACCP system, appropriate documentation and records must be kept and be readily available; e.g., cooking temperatures. It is unrealistic to operate a HACCP system or to demonstrate compliance with current legislation without providing evidence such as written records. The simplicity of the record keeping will very much depend on the nature and size of the business. The aim should be to maintain control without generating excessive paperwork.

A HACCP system provides food businesses with a cost-effective approach to control the safety of food from ingredients through production, storage and distribution, to sale and service to the final consumer. The preventive approach of HACCP not only improves food safety management, but also complements other quality management systems.

While HACCP is a legal requirement, it should not be considered a legal burden, but rather an insurance policy.

"The foundation of a food safety management system is having effective standards of good hygiene practice in place"

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