WHITE PAPER

Guidance on the use of Colour-Coding to improve food safety and quality

Acknowledgement - Vikan would like to formally acknowledge the original white paper, published by Remco Products Corporation, on which this version is based.

UNDERSTANDING THE HAZARDS THAT CAN AFFECT FOOD SAFETY AND QUALITY

FOOD-BORNE DISEASE

The greatest risk to food safety is from food-borne diseases. In the European Union (EU), over 320,000 human cases are reported each year, but the real number is likely to be much higher [1].The World Health Organisation (WHO) estimates that, worldwide, there are 600 million cases of food borne illnesses and and more than 420,000 deaths annually [2].

Food-borne diseases are caused by consuming food or drink contaminated by pathogenic (disease-causing) micro-organisms, such as bacteria (and their toxins), viruses and parasites. Many of these micro-organisms are commonly found in the environment, on raw fruit and vegetables, and in the intestines of healthy food-producing animals[3]. They enter the human body via contaminated food and drink, and are then present in the gastrointestinal tract where the first symptoms often occur (stomach cramps, vomiting etc.). From here some can enter the bloodstream and travel around the body to affect organs such as the kidneys, liver and heart. Consequently, the severity of a food-borne disease in humans can vary from mild symptoms to life-threatening conditions.

The risks of contamination are present from farm to fork and require prevention and control throughout the food chain. For those concerned with protecting food safety and/or working in the food processing industry the significance of food-borne disease is of particular concern.

The most common micro-organisms that cause food borne diseases are;

Bacteria

- Campylobacter, Salmonella, Listeria, Escherichia coli (E. coli), and Yersinia

Bacterial toxins

- Toxins of Staphylococcus aureus, Clostridium perfringens, Clostridium botulinum and Bacillus cereus

Viruses

- Calicivirus (including norovirus), rotavirus, hepatitis A virus, hepatitis E virus

Parasites

- Trichinella, Toxoplasma, Cryptosporidium, and Giardia

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ALLERGENS

The management of food allergens has become an essential part of food safety. For consumers with food allergies or food intolerances, eating even a small amount of the food to which they are sensitive can make them very ill and in some cases, cause potentially fatal anaphylactic reactions. EU regulations No 1169/2011(4) and No 78/2014(5) (amending (EU) 1169/2011), which relate to food labelling, lists 14 allergens that must be declared if present in a food product. The list consists of:

- cereals containing gluten,
- crustaceans,
- molluscs,
- eggs,
- fish,
- peanuts,
- nuts,
- soybeans,
- milk,
- celery,
- mustard,
- sesame,
- lupin and
- sulphur dioxide at levels above 10mg/kg, or 10 mg/litre, expressed as SO_2.

Many of these foodstuffs are common ingredients in the ready prepared foods we eat today. Their frequent use thus increases the risk of accidental contamination of other products. The food industry, therefore, needs to employ control measures that minimise the risk of allergen cross-contamination and thus improves food safety.

FOREIGN BODIES

Foreign bodies, i.e. something that the consumer perceives as being alien to the food, are the biggest single source of customer complaints for many food manufacturers, retailers and enforcement authorities[6]. Foreign bodies in foods are therefore justifiably of concern to all food manufacturers and retailers. The accidental inclusion of unwanted items can sometimes occur in even the best managed processes and, even if these items do not pose a food safety risk, there is nothing more off-putting to a customer than when they find what they consider to be a 'foreign body' in their food.

Publicity[7] given to foreign body contamination of foods has made consumers very aware of their rights, with regard to the safety and quality of the food they eat, and this has encouraged a litigious society. Therefore, any action that can be taken to lessen the incidence of foreign bodies in foods is of interest to food manufacturers, retailers and enforcement authorities.

THE IMPACT OF FOOD SAFETY INCIDENTS ON THE FOOD INDUSTRY

Whether it's packaged beef contaminated with E. coli, biscuits tainted with allergenic peanut resi- dues, or a spice mix containing a plastic brush bristle, when the safety or quality of food products has been compromised, the rippling effects of a recall can be staggering. The Grocery Manufacturers association (GMA) have concluded in a survey report that 18 % of the surveyed food factories impacted by a food recall had costs between $30 million and $99 million; 5% said the financial impact was $100 million or more related to recalling products and lost sales [8].

The UK Food Standards Agency (FSA) recently estimated the costs associated with food-borne illness in the UK at nearly £1.5 billion[9].

HOW TO MINIMISE THE RISK OF FOOD CONTAMINATION

There are various global and local government agencies, and expert guidance providers that publish advice on, how to maintain the integrity of the food processing industry including, EC Regulation 852/2004[10], CODEX[11], EFSA[12], GFSI[13], BRC[14] and the EHEDG[15]. To protect consumers from contaminated food, the EU has adopted an integrated approach to food safety, from farm to fork. The approach consists of

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both risk assessment (e.g. data collection, analysis, recommendations) and risk management (e.g. legislative measures, targets for reduction) measures.

HACCP

As with many manufacturing businesses, there are many ways to manage the hazards and risks but one universally popular system that has been recommended by regulatory bodies and adopted by the food industry is the Hazard Analysis and Critical Control Point (HACCP) food safety management system[11].

In the food industry HACCP is designed to analyse and control biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. Food processors are required by law[16],[17] to have a written food safety plan, which should include systematic hazard analysis, risk assessment and implementation of control measures. HACCP provides such a system that includes the identification of the "Critical Control Points" (CCP), i.e., those points, steps or procedures in a food manufacturing process at which control can be applied and, as a result, a food safety hazard can be prevented, eliminated or reduced to an acceptable level.

Once CCPs are identified, food processors can then implement appropriate validated controls and critical limits for each CCP, continually monitor and verify these CCPs, take corrective actions where necessary, and document that safe procedures are being followed. HACCP procedures can be applied and developed for food production, retail and food service operations.

HACCP *per se* is focused on the control of the raw material, the final product and the process. Underlying this principle HACCP focus is the HACCP Pre-requisites programme, which focuses on the production environment, people and services, including;

- Building design
- Equipment design
- Maintenance
- Sanitation (Cleaning and disinfection)
- Personnel hygiene
- Pest control
- Waste control

Best practice pre-requisites should be in place in all factories.

SANITATION (CLEANING AND DISINFECTION) AN ESSENTIAL HACCP PRE-REQUISITE IN THE FOOD INDUSTRY

One of the key pre-requisites listed above is sanitation. Good cleaning and disinfection practices are essential to minimse the risk of microbial, foreign body and allergen contamination of the food/beverage product. With regard to microbial control, cleaning is an essential pre-requisite to disinfection, as any organic material on the surfaces to be disinfected will render the disinfectant less effective or shield the microbes from the disinfectant[18].

Cleaning is a combination of four factors;
1. Time
2. Temperature
3. Chemicals
4. Mechanical effort/kinetic energy

None of these factors work in isolation but must be used in combination to achieve effective cleaning. However, the contribution each makes to the cleaning process will vary dependant on what is being cleaned.

For manual cleaning there are limitations on the temperature (of the water and chemicals) and the chemicals used, due to the direct exposure of the operator to them. Consequently, it is important that the cleaning equipment itself delivers effective and efficient cleaning, relative to the time and effort available for cleaning.

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The cleaning equipment itself must be appropriately designed, so as to minimise the risk of microbial, foreign body and allergen harbourage and cross-contamination. This would include consideration of good functional design (effective and efficient), good hygienic design (the cleanability of the equipment itself), equipment durability, and the incorporation of specialist design features, such as the availability of the cleaning equipment in different colours to allow colour-coded segregation of different food processing operations/areas.

COLOUR CODED SEGREAGATION FOR IMPROVED FOOD SAFETY & QUALITY

A simple, well-implemented colour-coding system can benefit a food processor in many ways and virtually any food production facility can be colour-coded. Many food processors already use colour-coded segregation of areas and equipment as part of their Good Manufacturing Practices, and as a proactive step in risk reduction as part of their HACCP pre-requisite programme.

British Retail Consortium (BRC) have in their food safety standard BRC v.8 specific requirements on cleaning equipment. In section 4.11.6 it is specified that: Cleaning equipment shall be: hygienically designed and fit for purpose, suitably identified for intended use (e.g. colour coded or labelled), cleaned and stored in a hygienic manner to prevent contamination.
The other major GFSI based food safety schemes (SQF v8, FSSC 22000 v4.1 and IFS v6.1) specify the need for cross-contact and cross contamination controls.

Primarily, the use of colour-coded cleaning equipment can help minimse the risk of product contamination by microbes, allergens and foreign bodies and consequently improve food safety and quality, save on expensive recalls and protect the reputation of the business. Colour-coding is often used to differentiate steps, parts or areas of a food production process.
Probably the most common use of colour-coding among food processors is to distinguish equipment for use in cleaning of food contact and non-food contact surfaces/equipment. For example, the colour Green could be used to identify cleaning tools used on the floor of the production area, black is common for use with drains, engineering, and outside areas, as it doesn't show the dirt, and blue is common for cleaning of food contact surfaces, as few foods are blue and the colour contrast allows easier visual detection of plastic fragments or stray filaments from the cleaning equipment in the food.

Other colours can be selected to differentiate between tools that are specified for use with particular allergens or cleaning chemical agents. This practice can help prevent the undesired occurrence of allergens in non-allergenic foods, and equipment contact with chemicals that could pose a safety risk to the food or damage the equipment. As an alternative to introducing new colours for allergens or chemicals colour coded rubber bands can be put on the cleaning equipment to distinguish tools used for particular allergens or chemicals.

Colour coded segregation can also extend to the areas in or lines on which the food is produced. This "Zone control" uses equipment of a designated colour for exclusive use within a particular area/on a particular line. For example, green may be assigned to facilities and processing lines that handle processed or cooked meats, while blue may be assigned to those handling raw meat, thus minimising the risk of microbial cross-contamination. For control of allergens, orange, pink, purple or lime equipment could be used exclusively in an allergen area thus minimising the risk of allergen cross- contamination.

Additionally, when designated coloured cleaning equipment is assigned to matched coloured zones, confirmation that a tool is in the wrong place is easy and quick to rectify, and is in compliance with the HACCP principles of monitoring and control.
Colour-coding can overcome language barriers.

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Employees of all ethnicities can easily learn a colour-based usage system and swiftly put it into action. Additionally, there are often fewer questions about where each tool should be used and stored, and employees know which colour tools are for their area of the facility, or step in the manufacturing process.

Colour-coding can help maximise the life of the cleaning equipment, and thus reduce cost. A cleaning equipment system which uses matching colour-coded wall brackets or shadow boards can encourage employees to properly store their tools. Thus, equipment damage is minimised, it lasts longer and the tools are less likely to get lost.
Furthermore, equipment storage can reduce the health and safety risk of trips and user injury from equipment left on the floor.

Finally, a well-controlled and documented colour coding system can make it easier for procurement to order replacement products when needed and provides documentation in support of the food safety plan to auditors.

There are, however, no regulations stating which colour should be used for different equipment functions or to designate different areas of production and it is often left to the individual site or business to decide on how best to proceed.

SUMMARY

Heightened food safety regulations are driving the need for documented food safety management systems. As a result, more food processors are using colour-coding throughout their facilities to help manage food safety risks.

Colour-coding can be an effective and easily understood way of minimising cross contamination. It has been shown that, with proper implementation, the benefits of a colour-coding system can outweigh the costs. Additionally, while it is not yet a firm requirement by law, colour-coding is often looked upon favourably by customers and inspectors as a practice that shows a companys commitment to food safety.

VIKAN GUIDANCE ON HOW TO DEVELOP A SUCESSFUL COLOUR-CODING SYSTEM

- **Keep your colour-coding system simple**
  Limit the number of colours used to as few as possible. Don't try to assign colours for each and every step of a complicated process.
- **Pick logical colours per area**
  Ensure that the colours you select make sense to your plant supervisors and employees alike. Do particular colours seem to logically symbolise zones or the food products processed in your facility?
- **Avoid complicated colour combinations**
  Mixing brush/squeegee heads and handle colours can sometimes result in confusion.
- **Roll out the colour-coding program all at once**
  Implement your colour-coding system within the zones affected all at once; have a definite end date for your old system and start date for your new colour-coded system.
- **Good communication is key**
  Meet with each of your shift managers first, then roll out the program to employees.
- **Reinforce the colour-coding with good signage, shadow boards, or colour coded equipment storage (e.g. wall brackets)**
  Make it clear (use images or multilingual text if necessary).
- **Be sure your tools and storage areas match**
  Make sure the tools are stored in the same area where they are used to further avoid confusion and cross-contamination.
- **Colour-coding plan and equipment maintenance**
  Regularly monitor and review your colour-coding plan, and check and maintain your cleaning equipment, so as to maximise your control of cross-contamination.

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- **Follow through**
  Utilise the same documentation at point of use, with your Purchasing Department and with your Quality Manager so everyone can work to the same system.

Vikan offer a comprehensive range of colour coded cleaning tools and equipment, and equipment storage options like colour coded wall brackets and shadow boards, all supported by documentation on aspects such as Declaration of Compliance when appropiate and technical specifications.

Vikan also provide a free and confidential colour-coded site plan development service to our customers.

If you require any further information about any of Vikans products or this service, please visit www.vikan.com.

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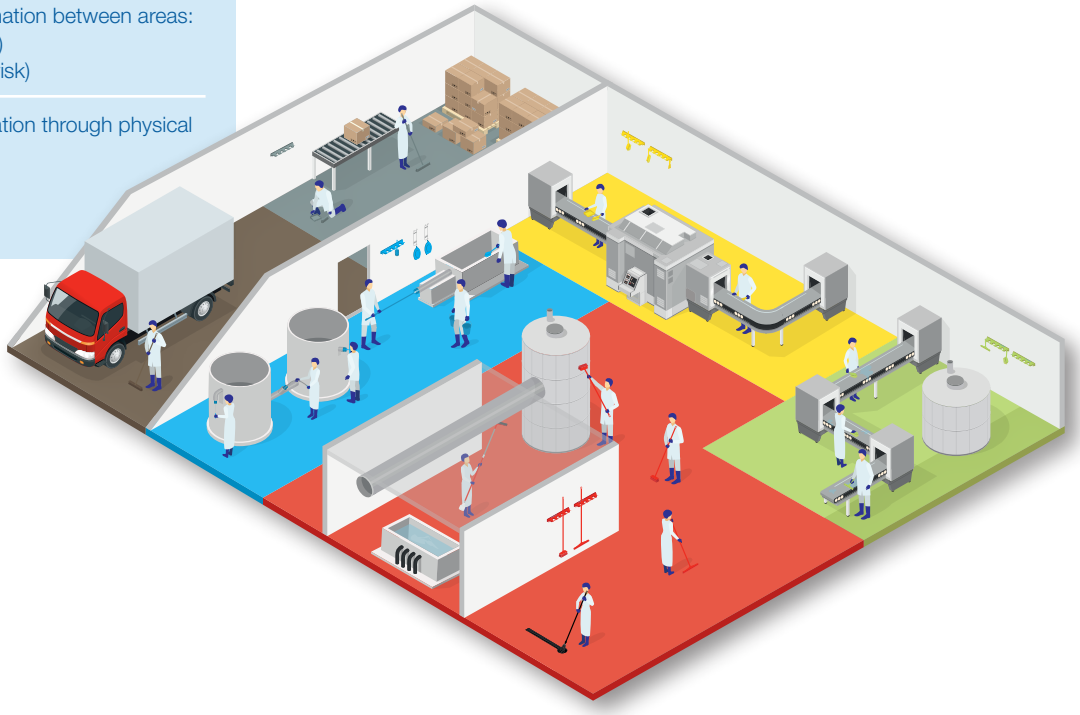
Sample Colour-Coding Systems

Preventing functional cross-contamination within an area:
- Green (non-food contact)
- Blue (food contact)
- Black (drains)

Preventing microbial cross-contamination between areas:
- Green (raw product area, low risk)
- Blue (cooked product area, high risk)

Preventing allergen cross-contamination through physical segregation:
- Orange (milk)
- Lime (wheat)



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