A cursory check of any of the popular newspapers reveals that the media is always interested in any story involving a foreign body in food – and the more gruesome or bizarre, the better.

Of course, not every foreign body incident gets reported, not every story in the papers can be trusted, and as the following will demonstrate, not every incident is quite as obvious or clear cut as the newspaper headlines suggest. That said, from the food manufacturer’s perspective, every foreign body incident is a potential issue, and always worthy of investigation.

Whilst the stories that make the papers are sometimes shown to be the fabrications of the supposed victims, there are many other foreign body incidents that expose serious flaws in a manufacturer’s processes or procedures, and thorough investigations are always required to help ‘plug the gaps’ and prevent a recurrence.

Extrinsic and intrinsic

Foreign bodies can be broadly classified as extrinsic or intrinsic. The former are materials that have no place in a food product, coming from external sources either by deliberate or accidental means. They might include swarf from process machinery, insects or other animal body parts, pieces of glass from an item broken in the factory, or any other item, such as a razor blade.

Intrinsic foreign bodies include ingredients such as bones and gristle in a meat product, or a leaf or stalk in a pack of frozen vegetables, or an ingredient in an unusual/unexpected state. They might also include fragments of packaging or a blemish on an otherwise perfect surface, for example a smear of raspberry jam on a white iced cake.

If the last example seems trivial, the point is that when the foreign body is first noticed, it may not be at all obvious what it is. To one consumer, the red smear will be interpreted as jam and probably ignored. To another, it could look like blood, and when their complaint comes in, that is the complaint that has to be investigated, proved or disproved, and then dealt with.

Identification makes sense

Some manufacturers might be tempted to deal with the apparent one-off complaint with a simple refund of purchase. This may be a mistake for several reasons; the complaint may not be genuine, or it may be the first of a series of incidents rather than a one-off and, it may be symptomatic of a bigger problem waiting to happen.

This is why it is always sensible to investigate the incident thoroughly, and to determine the precise nature of the contaminant, to discover its likely causes, and to act to resolve any issues and prevent a recurrence. Moreover, a thorough investigation demonstrates a commitment to ‘due diligence’ and should help in restoring consumer confidence. In a case where many products and many consumers are affected, the requirement to restore confidence may be very pressing indeed.

What can be investigated?

The microscopy team at Reading Scientific Services Ltd (RSSL) investigates approximately 1,000 foreign body incidents every year, providing identification of the contaminant, possible explanations for how it came about, and consultancy on resolving specific issues. Broader help is also available in training and consultancy on risk assessment, HACCP and related disciplines, which are designed to prevent incidents from occurring in the first place.

A broad spectrum of technologies is routinely used in foreign body investigations, reflecting the diverse nature of potential contaminants. However, relatively simple...
light microscopy is often the starting point of any investigation, as it can be used to determine features that are typical or characteristic of the likely candidates, thereby directing the scientists to the more sophisticated methods that will provide ultimate confirmation.

Different techniques are required for different types of contaminant. So, for example, a scanning electron microscope fitted with an energy dispersive X-ray (EDX) detector is useful for identifying the elemental composition (and hence providing a positive ID) for items such as glass fragments.

On the other hand, plastic fragments, which may look like glass, require confirmation using a technique known as FT-IR (Fourier transform - infra red spectroscopy). For the purposes of this article there is no need for detailed discussion of the technologies. The point is that even the smallest contaminant can usually be identified, provided the laboratory doing the work has the appropriate expertise and equipment.

It is worth noting that identification goes beyond merely describing the contaminant as a piece of plastic, a sliver of glass, or a fragment of bone etc. It matters to know, and it is usually possible to tell, what type of plastic, what type of glass and what kind of animal.

Taking glass as the example, an investigation by RSSL will differentiate between the different types of glass used in a domestic or commercial setting. It can differentiate between sheet glass and spun glass, boro-silicates (Pyrex), leaded glass and specialist glasses, such as those used in laboratories.

Moreover, it is also sometimes possible to tell whether the foreign body has been processed alongside the food, added afterwards, or come into contact with any other ingredient or item that might indicate where it came from and how it got into the product.

A key resource in identifying contaminants is the availability of reference materials against which to check the sample provided. RSSL investigated a fragment of material provided by a client. Analysis by the techniques of FT-IR and EDX identified the sample as silicone rubber, matching the spectrum against a reference held within the instrument’s own database of materials.

The next step was to identify which, if any, of the several potential sources of silicone rubber in the factory had permitted to create the contaminant.

The FT-IR and EDX techniques referred to above were unable to distinguish between the various samples that the client provided. However, using X-ray microfluorescence (XRF), which is more sensitive to heavier elements, the relatively high concentration of cerium in the contaminant was more easily matched against just one of the samples. This gave a very clear indication of where the fault had occurred and allowed the manufacturer to improve its maintenance/replacement strategy.

More case studies

The sheer variety of foreign body incidents means it is impossible to talk in much detail about the specifics of investigations. For the analytical laboratory the response to finding something that looks like glass in a can of peas, is very different from finding something that looks like part of a dead rat, or a pharmaceutical product, or a syringe. The analysis and the repercussions are going to be very different in every case.

The following case studies cast a little more light on this variety, and the variety of circumstances that lead to foreign bodies being discovered.

- Sharp practices.
  A family complained of finding a blade inside a pack of cooking fat, involving the police and trading standards in the process. Investigations by RSSL demonstrated that there was a blade in the product, but there was no damage to the packaging, and crucially, internal ‘scanning’ of the product consistent with the blade being inserted after the block of fat had been formed. This indicated the blade had not entered the product during manufacture. Presented with this finding, the customer admitted to having inserted the blade herself in an attempt to win compensation.

- Staple diet.
  On-line metal detectors picked up on several products that contained metal pieces. Investigations by RSSL identified the fragments as being office staples. Regular markings on the staple body indicated that all had been issued from the same machine (rather as firearms experts can identify bullets fired from the same gun). A thorough check was made of every stapler within the factory site.
  Once the stapler was identified, it did not take long for a disgruntled employee to admit to firing a few staples into one of the factory's small mixers.

- Obvious foreign body.
  When the maintenance team realised that one of its tools had been mislaid, the obvious conclusion was to question where the team had been working in previous weeks. One location that had to be checked was a silo, in which the item was duly found. Identifying the foreign body was simple enough, but now the manufacturer needed to know if and how it might have contaminated batches that were waiting to be sent out. RSSL did a full toxicology check on the item, and a full assessment of potential for taints, and was able to conclude on this occasion that the product was safe for release.

- No glass.
  A consumer complained that a tin of fish contained several fragments of glass. When the pieces were sent to RSSL it was quickly shown that the fragments were actually crystals of struvite, which can be formed during the canning process from a reaction between naturally occurring ingredients.

- Insects.
  A whole lizard was found in a food product, and using a biochemical method, RSSL was able to demonstrate that it had probably been processed and cooked along with all the other ingredients. Using external, specialist expertise, RSSL was further able to propose a species and country of origin, allowing the manufacturer to strengthen specifications and audits on a particular supplier.

- Black bits.
  Some black markings were appearing on a white iced sweet. A number of possible causes were mooted, such as oil splashes from lubricants, printer inks, factory dirt and so on. Using X-ray analysis on the scanning electron microscope, RSSL identified the elemental composition of the black bits and showed that it was likely to be metal dust from a particular piece of production equipment. Maintenance procedures were tightened as a consequence.

Conclusion

There is a truly bewildering number of foreign body possibilities that ‘lie in wait’ for food manufacturers. RSSL’s own rogue gallery of incidents includes examples that are both bizarre and bewildering, often exposing practices on the factory floor that no one had ever anticipated or thought it was necessary to control against.

This observation is arguably the single biggest reason for investigating every foreign body incident, because it is not enough to identify the foreign body and to respond to that individual incident. Rather, every incident should be used as an opportunity to learn about vulnerabilities in processes and procedures, and to dictate how improvements should be brought about.

FaxNOW +44 118 986 8932
enquiries@rssl.com