



Food safety in a globalised world

Keeping our food safe in the 21st century



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Executive summary

Contaminated meat, mislabelled packaging, tainted baby formula – food recalls have become a regular feature in today's headlines. The reason is clear: we all eat and we want to be sure that what we and our loved ones consume is safe and wholesome. But is it still?

Following the headlines is one thing, seeing the full picture is another. This is why Swiss Re is committed to understanding food safety and its potential impact on the insurance industry, the research on which has led to Swiss Re's product liability and product recall insurance.

Has the number of recalls really increased? Is the severity of these recalls rising? How safe is food today in general? These were the questions we asked ourselves as far back as 2001, when the issue first appeared on our radar screen and we started working on it.

The short answers to our three questions are:

- Yes, the number of recalls of contaminated food is rising
- The severity of recalls varies greatly
- The food on our plates is generally safe, but
- The food that is not safe must be our chief concern

Why? Just one example: the vast majority of all recalls are triggered by a serious health threat with the potential to sicken people. In many jurisdictions this makes a recall mandatory by law. So while the bulk of our food is safe, missing just one batch that is not can have devastating and even fatal consequences for consumers. In addition, producers may incur severe financial loss and reputational damage.

Unsafe food generally affects sensitive populations. People with weakened immune systems and allergies are most exposed, and their number will rise. The factors driving this trend are ageing societies, an increase in allergies in the overall population and the fact that malnourishment as a source of weak body defences is still prevalent in many countries. In the future, food producers clearly will have to be yet more diligent in making sure only food safe to

consume makes it to the shops and shelves of the world.

In a more globalised economy, ensuring this level of safety is growing to be an ever greater headache for firms. When ingredients and technologies are sourced worldwide from different partners, complexity rises and with it the demands food companies have to meet to satisfy their consumers' expectations.

Failing in this process often leads to a drop in sales, sometimes even to bankruptcy. Examples of companies who went down this route can be found across the globe. So what can be done to avoid a similar fate?

As this publication shows, the risk management tools to ensure our food is safe already exist. They must be applied and adapted to ever more complex global markets and supply chains. Adaptation also means taking lessons learnt to places where they are yet unknown and tailoring them to local conditions.

This publication aims to be part of this application and adaptation process by providing data and an overview of best practices in food safety, all of which is a prerequisite for insurance.

Even the best-prepared companies carry a residual risk. By insuring this risk, they can mitigate any loss incurred and ensure that they remain in business.

Again, we all eat. And what we eat determines in part how healthy we are. Partnering in providing safe and nutritious food will therefore not only benefit our health – it also benefits society at large.

The healthier we are, the better able we will be to progress as one global community with a common interest in food safety.

Jayne Plunkett

Head Casualty Underwriting
Reinsurance

The food risk landscape today

Food safety vs food security

Although often used interchangeably, food safety and food security are in fact distinct concepts. For the purpose of this publication, we use the definitions by the Food and Agricultural Organisation (FAO) and International Standard Organisation (ISO), as quoted here:

“**Food security** exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.”¹

Food safety “specifies requirements for a food safety management system where an organisation in the food chain needs to demonstrate its ability to control food safety hazards in order to ensure that food is safe at the time of human consumption.”²

In Germany in 2011, an E. coli outbreak traced to fenugreek sprouts³ infected 3 950 and left 53 dead. The same year in the USA, a listeria outbreak associated with cantaloupe consumption⁴ caused 146 infections and 33 fatalities. And in China, more than 300 000 injuries and 6 infant deaths were recorded after milk was tainted with urea and melamine.⁵

This is just a snapshot of food contaminations that made headlines around the world in recent years. They stand as examples of what can go wrong if food is not safe to eat. Other cases not mentioned above involved foreign objects, toxic substances or allergens. No matter their cause, foodborne diseases are tragic in that they often cost lives and make people seriously ill.

The above events are also prime examples of the many aspects of food safety. Yet for each of these major events and others like them, there are hundreds of lesser cases that did not make the news, either because they affected fewer people or inflicted no long-term harm.

All the events had in common that it took a long time to trace where the contamination had originated. In the German E. coli outbreak, for instance, cucumbers from Holland and tomatoes from Spain were initially suspected to have been the source. The suspicions later proved false, but consumers avoided produce from both countries, costing farmers there a large amount of income.⁶

We will discuss the most likely source of infection when we return to this case later in this text. First, we need to look into another question: why is it so complex to trace the root of food contamination? The answer quite simply is, globalisation and the complexity of the food supply chain.

Global trade in food – a growth story in complexity

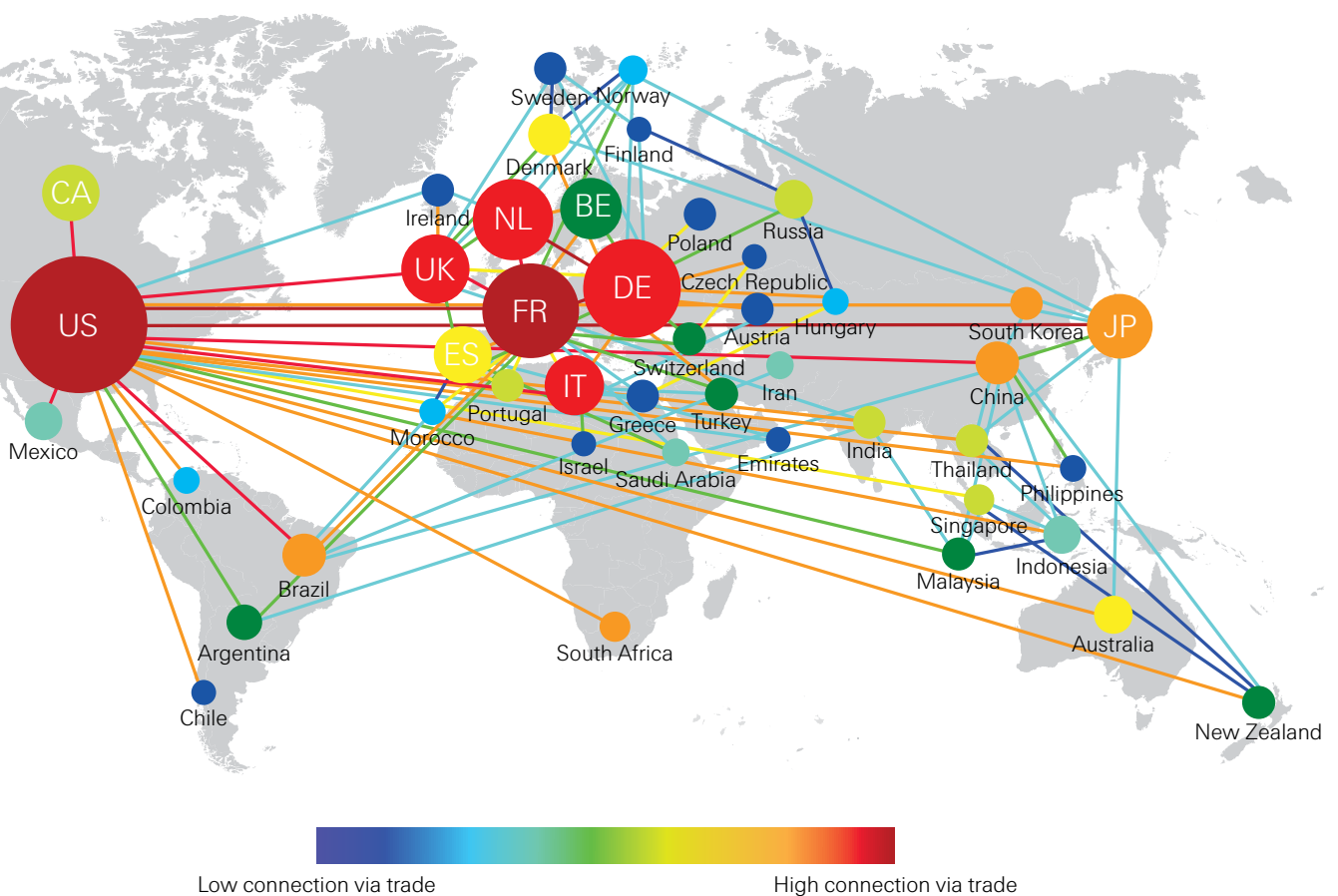
Chinese restaurants in the Americas, sushi in Europe, Swiss cheese in Asia, maize from the corn belts of the world for emergency aid across the globe – the benefits of world trade in food come to everybody. We can now eat any cuisine in nearly every country and we have enough to eat, even if a drought, war or flood threatens our homegrown foods.

All of this is possible because shipping, processing, packaging and trading of finished and raw foods is the norm. The world trade volume in food and agricultural products reached close to USD 1.4 trillion in 2012, making it the third-largest category after non-pharmaceutical chemicals and fuels.⁷

While this puts food on our plates, it also creates new risks. Shipping goods around the world fragments the supply chain. It becomes more difficult to ensure that ingredients and finished products are safe to eat the moment they arrive on our shelves when the responsibility for food safety is spread over many different business partners. Most of these do not know each other, yet they all have to work as one to make products safe.

How complex this system has become can be seen in Figure 1. It illustrates the movement of food across the globe between major trading partners.

Global food trade network



Based on Ercsey-Ravasz et. al 2012 doi:10.1371/journal.pone.0037810

Figure 1

In this global movement of goods, the possibilities for error are nearly boundless.

They may start with contamination on the farm, for example with E. coli in the run-off from a cow shed contaminating vegetable crops nearby. Contamination may also occur during transport, processing or packaging, with germs, unapproved ingredients or foreign objects. Then, there is the issue of improper storage or labels that do not warn of allergens such as nuts or other ingredients. The list goes on.

If something does go wrong, the effects can be as devastating as in the E. coli contamination in Germany. Again, that event also illustrates well the complexity

of tracing the cause of product contagion. After a lengthy investigation, the consensus among the researchers and investigators today is that the most likely origin were fennel seeds from Egypt that had been contaminated in the Nile Valley fields before packaging.⁸ The fennel grown from the seeds carried the contamination in it. The Egyptian government disputes this finding to this day, however.

In summary it can be said that the complexity of the supply chain is one of the key reasons for food contamination. But how bad is it really? A look at the numbers will tell us more.



What goes wrong – and how often

US recall classification

Recalls are classified according to their potential seriousness. In each case, classification is the task of the government agency responsible for overseeing the recall. Both the Food and Drug Administration (FDA) and the Food Safety and Inspection Service (FSIS) classify recalls according to the following system:

A **Class I** recall is a situation in which there is a reasonable probability that the use of or exposure to a violative product will cause serious adverse health consequences or death. Examples of a Class I food recall include the presence of pathogens like E. coli or Salmonella or food with undeclared allergens.

A **Class II** recall is a situation in which use of, or exposure to, a violative product may cause temporary or medically reversible adverse health consequences or where the probability of serious adverse health consequences is remote. For example, the presence of very small amounts of undeclared allergens typically associated with milder human reactions, such as wheat, or contamination with metal or glass fragments.

<http://www.fda.gov/Safety/Recalls/ucm165546.htm>

Swiss Re has been tracking the developments in the food risk landscape since 2001.

To see why, it helps to look at trends in one feature in this landscape: food recalls. These are often mandated by regulatory requirements to avoid large cases of food poisoning or injury due to foreign objects. In other words, each recall represents a near miss, or an event

which could have had a large-scale impact ranging from illness to death but did not. From this perspective, then, looking at food recalls as a proxy for product liability claims makes good sense.

The EU provides data via its RASFF system.⁹ Other data sets are supplied by the United States Food and Drug Administration (FDA), the Food Safety

Recall reasons by type: US

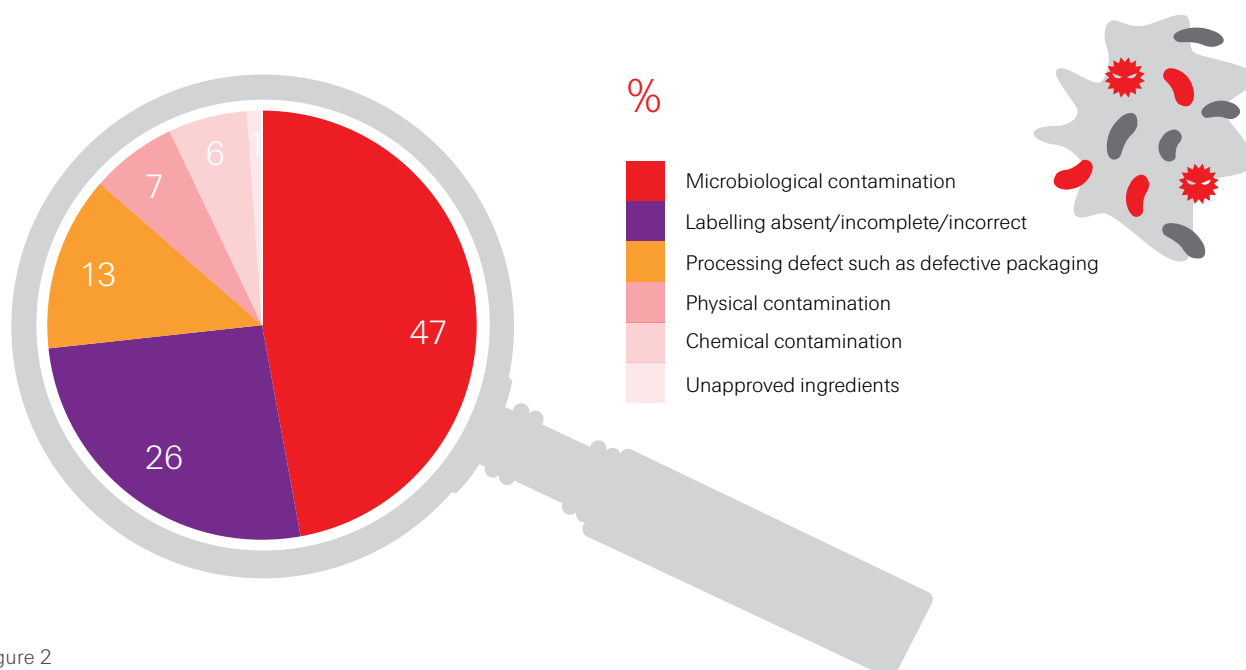


Figure 2

and Inspection Service (FSIS) of the US Department of Agriculture (USDA) and other government agencies in the US.¹⁰ Although dietary patterns vary worldwide, the regulatory framework, the oversight by the regulators and the very long history of the records make US data the best sample to date to analyse for food safety-related information.

So, what are the trends? We analysed the last ten years of data in the US and a first look showed large fluctuations from year to year. In addition, there were several regulatory changes in the US in 2006 which affected the reporting of serious incidents. For a better indication of a long-term trend, we therefore decided to look at the first and last three years in the 2002-2014 period.

The result can be seen in Figure 3. The trend is that recalls increase. Although some of this may be due to the changes in law, these can not explain all of the

increase, which suggests that recalls in general are on the rise. But the data tell us even more. Two-thirds of all recalls are designated as "Class I" – meaning that adverse health consequences, even death, are possible. We can infer from this that these were recalls made out of concern for public health.

The number one hazard endangering public health is microbiological contamination, as can be seen in Figure 2. While this has always been a key focus of risk managers, the number two hazard, labelling, also calls for close attention. In a world where more and more people are affected by allergies, labelling will become ever more important. Food contamination also translates into health effects, as the estimates by the US Centres for Disease Control (CDC) show (Table 1). Death and illness by food contamination is a major burden to the public health system in the US.

US recalls over time

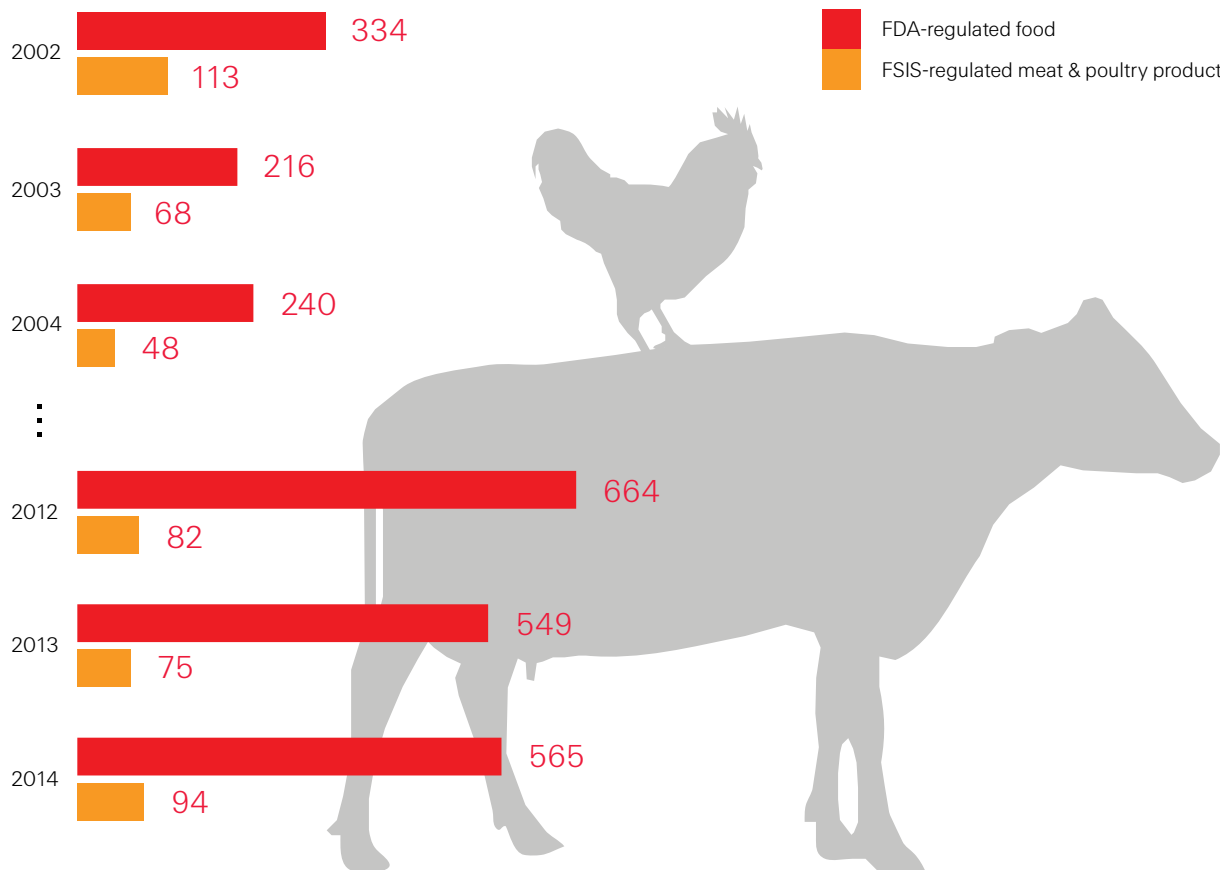


Figure 3

Foodborne agents	Estimated annual number of illnesses (90% credible interval)	%	Estimated annual number of hospitalisations (90% credible interval)	%	Estimated annual number of deaths (90% credible interval)	%
31 known pathogens	9.4 million (6.6–12.7 million)	20	55 961 (39 534–75 741)	44	1 351 (712–2 268)	44
Unspecified agents	38.4 million (19.8–61.2 million)	80	71 878 (9 924–157 340)	56	1 686 (369–3 338)	56
Total	47.8 million (28.7–71.1 million)	100	127 839 (62 529–215 562)	100	3 037 (1 492–4 983)	100

<http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html>

Table 1



But what might explain why pathogens seem to be behind nearly half of all recalls in the US? This brings us back to the supply chain. Greater complexity leads to more interfaces, which increases the chance for error.

One example of this is failure to maintain adequate storage temperatures. When food becomes too warm, pathogens start to grow. The result is that food that can make consumers sick ends up in stores.

Adding to the complexity is that much of the meals we consume today are “ready to eat”, which brings us to another interesting point in the data. Looking at food categories, ready-to-eat meals are the number one recalled food product category by a wide margin, as shown in Figure 4. Why is this the case?

Ready-to-eat meals are mass-produced from many different ingredients. A wide variety of suppliers deliver the components to a plant for final assembly into meals. Ingredients are trucked in “just in time”. Once processed, the food is transported to warehouses by another

third party, the logistics firm. These warehouses may be managed by yet another value chain partner. In the end the meals arrive at the store, which often is another entity altogether.

Maintaining the consistently high quality standards necessary to keep the often-perishable product food safe is a challenge even in places where only meat, vegetables or milk products are processed. For a ready-to-eat meal, different foods all come together, in a complex system prone to errors. This explains why the ready-to-eat food category is leading by share of recalls. The rise in the consumption of convenience food over the years has accentuated this trend further.

Ready-to-eat food highlights the main risk drivers in today’s food value chain: a more complex supply system, expanding demand and the difficulties that arise when a network grows both in volume and complexity – as does the world’s food production industry. But what does this mean for us right now and going forward?

Ready-to-eat meals: most affected by recalls

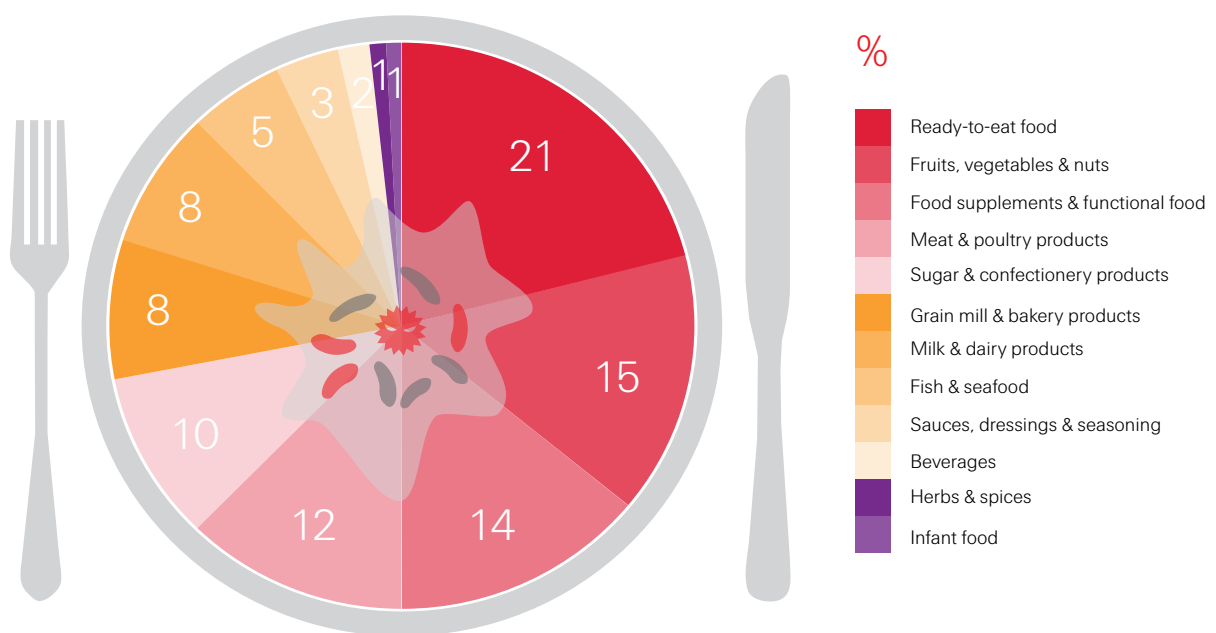


Figure 4

Food safety and public health

The World Health Organisation (WHO) observes World Health Day every year. In 2015 the day was dedicated to food safety. In a media release for the event¹¹, WHO Director General Dr Margaret Chan explained why food safety is so important:

“Food production has been industrialised and its trade and distribution have been globalised. These changes introduce multiple new opportunities for food to become contaminated with harmful bacteria, viruses, parasites, or chemicals. A local food safety problem can rapidly become an international emergency. Investigation of an outbreak of foodborne disease is vastly more complicated when a single plate or package of food contains ingredients from multiple countries.”

The WHO statement echoes what was said earlier in this publication. On the public health side, the effects of

compromised food safety are staggering. In 2010 alone,

- there were an estimated 582 million cases of 22 different foodborne diseases and 351 000 associated deaths;
- the disease agents responsible for most deaths were Salmonella typhi (52 000 deaths), E. coli (37 000) and norovirus (35 000);
- the African region recorded the highest disease burden for foodborne illnesses, followed by Southeast Asia;
- over 40% of people suffering from diseases caused by contaminated food were children aged under five years.

The human suffering and the resulting cost and burden to the public health system alone make it clear that assuring safe food is a must in a globalised world.

The economic impact of contamination – case study Germany

2011

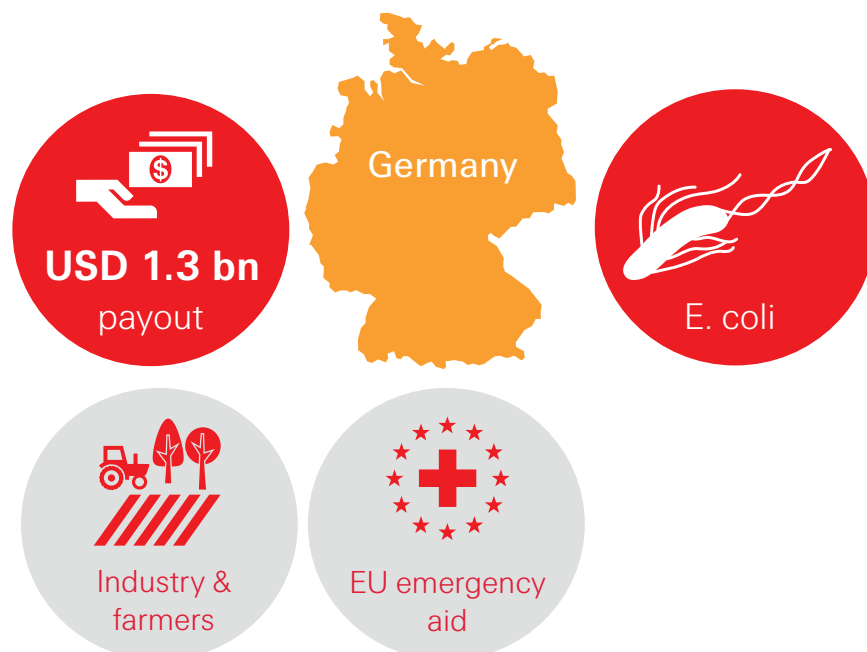


Figure 5

The economic impact of food contamination

Unsafe food poses major economic risks, especially in a globalised world. The aforementioned 2011 E. coli outbreak in Germany reportedly cost farmers and industries USD 1.3 billion in losses and USD 236 million in emergency aid payments to 22 EU member states, according to the WHO.

The US Department of Agriculture (USDA) assessed the cost of food contamination cases in the US for 2013.¹² Together with the US Centres for Disease Control (CDC), the USDA calculated the costs of the 15 main foodborne illnesses. Payments considered included outpatient and inpatient expenditures on medical care and lost wages associated with the acute illnesses and the chronic conditions that sometimes follow.

The results were a staggering USD 15.6 billion annually. The bill was generated by 8.9 million Americans sickened by one of the 15 pathogens. Of those sick, 53 245 needed to be hospitalised and 2 377 did not survive.

With foodborne illnesses, some of the cost can be charged to the companies where the infections originate. Not surprisingly, food safety-related issues are high on the radar screen of food companies, as a US Grocery Manufacturers Association survey shows.¹³

US food contamination and public health

2013

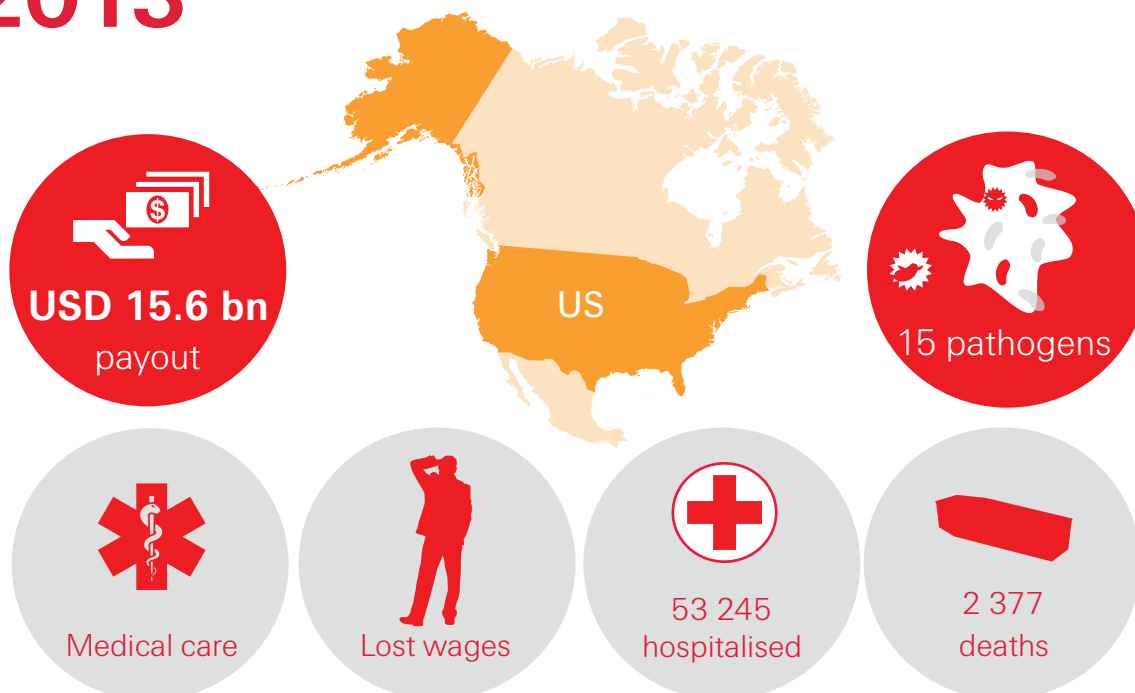
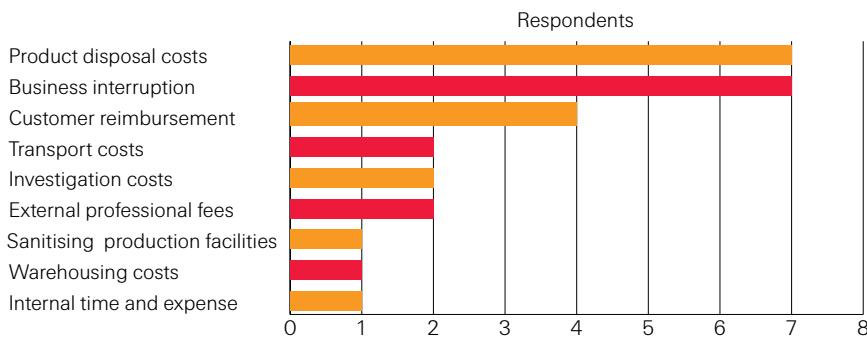


Figure 6

The business impact of food contamination

Which of the following cost did your company capture when dealing with product recall? Check the three largest cost drivers.



Source: Capturing Recall Costs; Grocery Manufacturers Association 2011

Figure 7

In 2011 the Grocery Manufacturers Association (GMA) in the US surveyed 36 major international companies active in the food sector. More than half the companies (55%) had experienced a product recall event in the five years prior.

Product recall costs can easily reach the double-digit million-dollar range – some even costing more than USD 100 million. In the 2011 survey, respondents cited business interruption and product disposal as their largest recall cost drivers (Figure 7). Yet behind these numbers lurks an even bigger problem: how to regain the trust of consumers.

In the 2011 GMA survey, a top concern was protecting brands. The need to protect a brand is even greater where the product name and the company name are the same. However, damage to the brand or company reputation is difficult to quantify and challenging to recover financially.

Brand and/or reputation damage is a problem especially for the 25 000 smaller companies making up

9 out of 10 enterprises in the food industry in 2013.^{14 15}

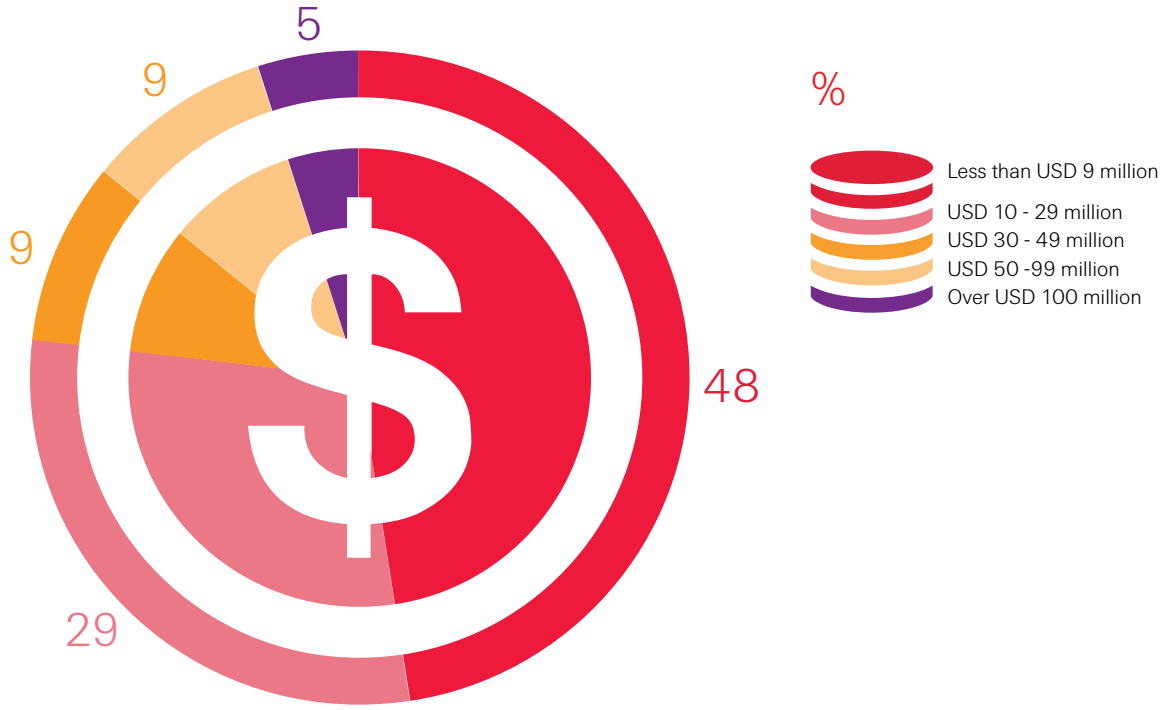
For these businesses with less than 100 workers, even a USD 9 million recall can be too much. High recall costs combined with plummeting sales following a recall can easily force them into bankruptcy.

As it turns out, the same applies to bigger players. Since 2007, at least three large companies in the US alone filed for bankruptcy or had to be rescued by merging with a competitor.¹⁶ It is no wonder then that many food producers surveyed ranked the risk of a product recall among their most severe strategic threats, with 81% of respondents deeming this financial exposure as “significant” or “catastrophic”.

To be sure, companies are also proactive in guarding against this type of threat. They look for two things: best-in-class risk management practices, to be prepared and insurance, to be protected in case something does happen and a recall is needed.



Estimated recall cost (direct cost, loss of profit) to US companies



Source: Capturing Recall Costs; Grocery Manufacturers Association 2011

Figure 8

ISO 10377 – Consumer product safety – Guidelines for suppliers

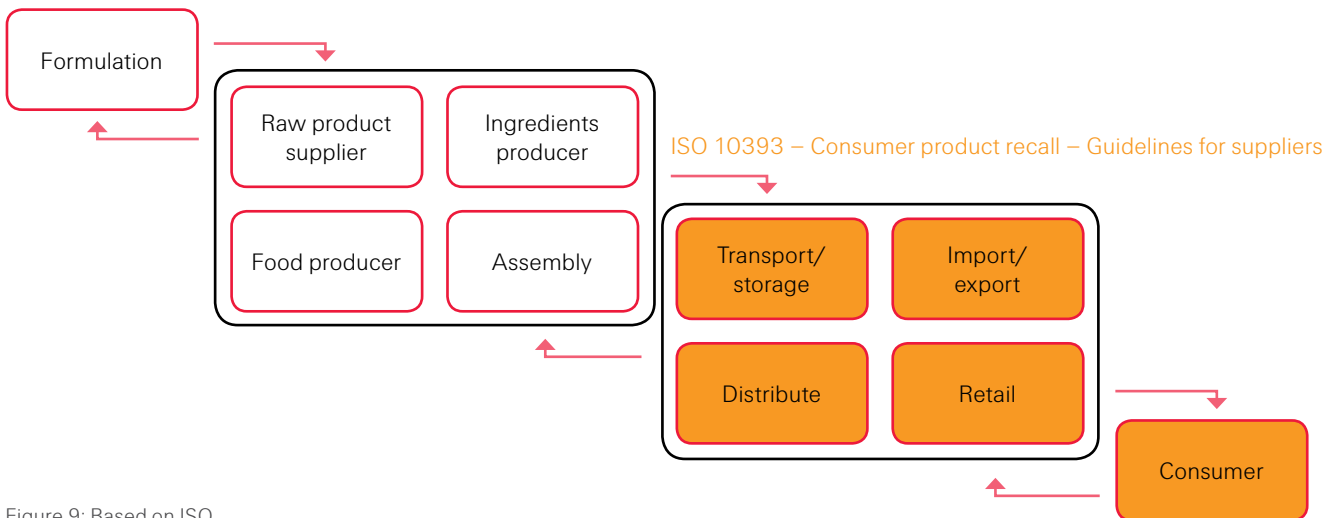


Figure 9: Based on ISO

What can be done – food risk management for the 21st century

What we do today in food safety was inspired by the US space programme. In the 1960s, safe food was a key requirement for going to the moon because food poisoning could have jeopardised a mission.

Common knowledge existed on how to prepare and store food. It was known that cooking it at over 100°C made food microbiologically safe. Also common wisdom was that freezing ingredients like meat would allow shipping them to faraway places and still safely process them there.

NASA took a look at all of this know-how, analysed it and put it in a control system named Hazard Assessment and Critical Control Points, or HACCP. What the system does is help find points where things can go wrong – such as cooking at under 100°C – and then put a control in place there to make sure nothing can in fact go wrong. In our cooking example, this would involve either testing the food for germs or having a thermometer reading of the whole process to show the meal cooked at over 100°C.

How complex this becomes for anyone other than NASA is clear to see in the risk management diagram, which shows the product life cycle of food (Figure 10). While fully in control over everything that happens in his sphere of influence, a producer has only limited control over some third parties (suppliers, transport) or none at all (entities not directly employed and consumers).

And yet, being responsible for a product means having to address all partners in the chain. Some can be checked –

suppliers and trucking companies, say – but for others the producer must make sure that instructions and labels are clear and up to date. The HACCP helps with that.

The same principles that underpin HACCP are also the basis for many legal requirements in the food world, including FDA guidelines¹⁷, the Codex Alimentarius¹⁸ and EU regulations.¹⁹ In addition, the system inspired an official ISO standard – ISO 22 000,²⁰ which defines the baseline of best practices in the field – and even a guideline by the FAO/WHO on small and less developed food businesses.²¹

This is how HACCP has come to form the backbone of food safety in many countries. Yet as the food world evolves and lessons are learnt, HACCP is constantly updated and refined. Staying abreast of the latest developments is one responsibility of every food producer. Beyond that, producers must also think about the unthinkable: that something might go wrong. And managing that risk is as important to preventing loss of life as is all the preparation HACCP enables.

What can be done – food risk management for the 21st century

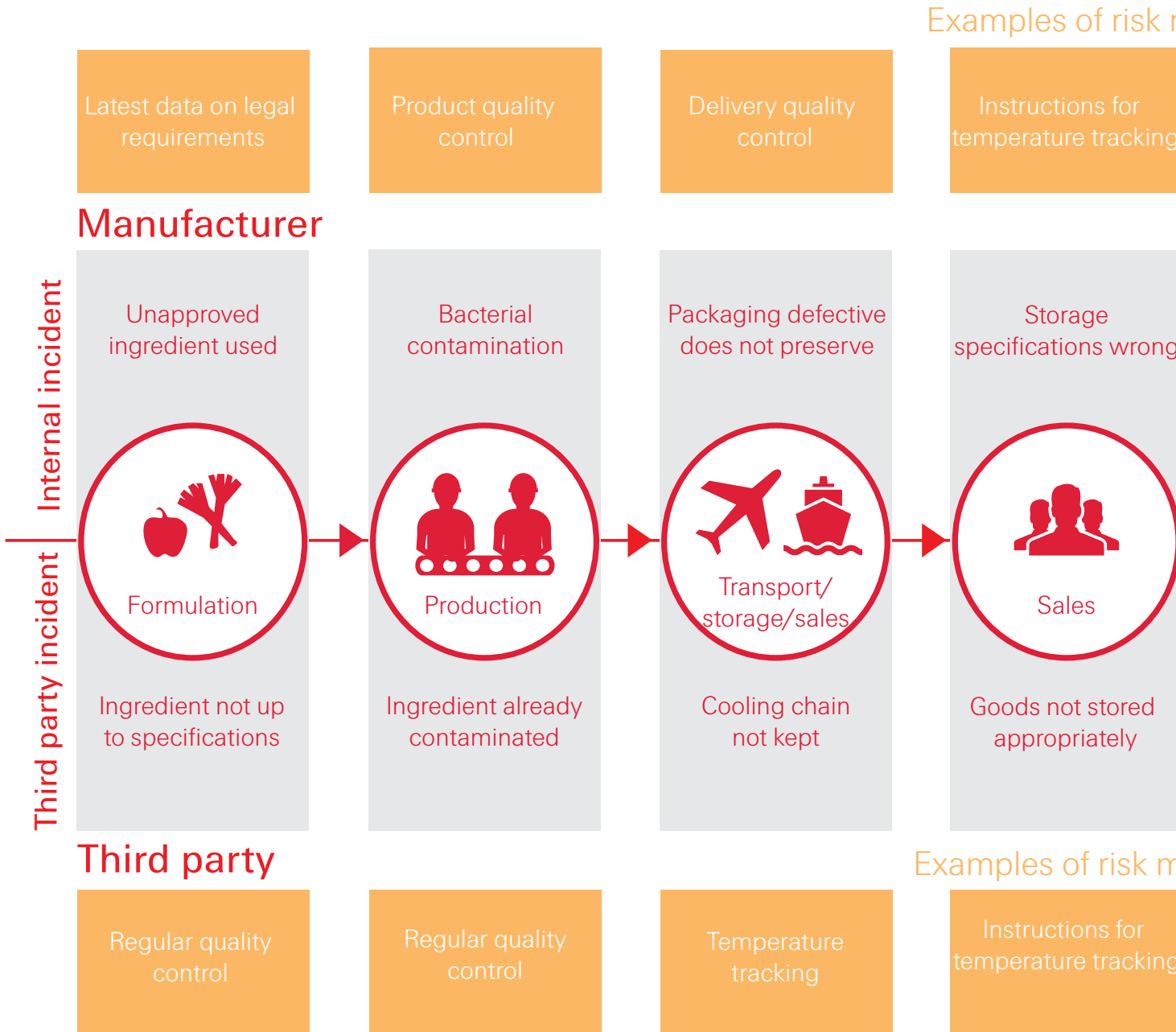


Figure 10

management measures

Instructions for temperature tracking

Quality control labels

Clear shelf-life labelling

Clear instructions for packaging disposal

Storage specifications not followed

Cooking instructions list too low temperature

Product eaten after "best before" date

Food packaging causes environmental problem



Storage

Preparation

Consumption

Disposal

Cooling chain not kept

Cooked at too low temperatures

Product eaten after "best before" date

Incorrect disposal by retailer

management measures

Instructions for temperature tracking

Instructions

Clear shelf-life labelling

Clear instructions for disposal

Crisis management in food safety

Even the best HACCP system will not eliminate all food contamination cases. It will simply minimise the number of occurrences over time. But any good risk management is also about accepting that some things will go wrong – and being able to act in such a way that injury and death can be minimised.

Where food contamination does occur, this means moving any products unfit for use off the shelves, as fast as possible. But whose shelves are we talking about? In food retail they can be the wholesalers', distributors' or retailers'. In addition, they can be in consumers' pantries or restaurant storerooms. Next, what items should be recalled? Every unit ever produced, or is it possible to identify specific lots or batches that pose the greatest risk?

To reach the people affected and only collect unfit products, the first priority is traceability. Upstream, companies must be able to trace back to suppliers or farmers where the error occurred to identify all products affected. Downstream, they need to know how many products affected went to whom and where these currently are in the logistics chain. Products receive labels to help identify how many units were produced and when. A good traceability system will also account for what went into a

batch and where this batch went. Having contacts across the value chain will allow informing parties as soon as possible that some item needs to be removed. Ideally it can be tracked down and intercepted while it is still in distribution. But if the item was sold and danger is imminent, then public warnings (via print, television and/or social media etc) and product recalls cannot be avoided.

A recall of an unsafe product need not be a negative thing – quite the opposite. If done right, it shows to consumers that the firm issuing the recall is a responsible company that cares about its customers.

For a recall to be successful, it must be communicated effectively. Specialised crisis management plans must be in place. An example is given in Figure 11. In today's world, such plans should include (social) media as well as the full system of traceability so that the recall is fast and professional. Normally, the entire process is recorded in a recall plan for which many templates are available and also some ISO guidance in the form of ISO standard 10393:2013 (Figure 9).²² A recall plan should not only look at the company itself but also include suppliers as well as distributors wherever possible.

Crisis management planning



Source: Deloitte Study - Recall Execution Effectiveness: Collaborative approaches to improving consumer safety and confidence 2010

Figure 11

Insuring the food value chain

In addition to a sound risk management process to better understand and reduce food safety risks, insurance may help a company transfer some of the residual risk. Product recalls in the food industry and their potential reputational damage can have a catastrophic impact on the balance sheet of a company. Worse, people may come to harm by consuming contaminated food and claim for compensation for the bodily injury suffered. Large-scale product recall actions and product liability claims as well as lost trust and reputation have pushed some businesses out of the market.

Insurance as part of a company's enterprise risk management will help lessen the financial impact and recover faster from catastrophic food safety events, by providing professional claims management services and financial protection.

Having long experience in delivering risk transfer solutions to the food industry, insurers are professional partners for food companies. They have the know-how to evaluate the insured firm's food safety risk management processes and its food-related product recall and

product liability exposure to develop appropriate tailored risk transfer solutions. The right insurance solution for a given firm will be determined by the risk exposure of that company and the level of protection needed.

A variety of insurance products are available, each addressing specific needs. There is product recall/contaminated product insurance to cover the costs of recalling accidentally or maliciously contaminated food from the market (Table 2), to recoup the loss of profit and compensate for expenses to regain former market share. Where compensation is needed for legal liability to consumers for bodily injuries, there is product liability insurance. The terms and conditions as well as the insurance limits will vary according to the individual risk assessment and risk acceptance of the insured company.

Beyond the financial security insurance provides by compensating consumer's product liability claims and firms' recall expenses, insurance companies help producers improve their safety systems by sharing the know-how they gained by auditing risk management systems worldwide.

Insurance products for food contamination

Type of insurance product	Product liability insurance	Product recall insurance (food industry)	Contaminated products insurance
Scope of coverage	Compensation of third party liability claims for bodily injury and property damage caused by an impaired product (eg contaminated food)	Expenses for the recall of any accidentally or unintentionally contaminated, impaired or mislabelled product(s) which resulted in or the consumption of which would result in bodily injury, sickness, disease or death of any person(s).	Expenses related to accidental contamination, malicious contamination and product extortion demands
Covered loss	Compensation of justified claims and defence costs	Insured's recall-related expense, such as: <ul style="list-style-type: none"> ■ notification of consumers ■ testing/checking ■ costs of disposal ■ costs of replacing recalled products or ■ reimbursement of purchase price 	Losses covered may encompass: <ul style="list-style-type: none"> ■ insured's recall expenses ■ pre-incident consulting and post-incident crisis management ■ third-party recall expenses ■ loss of gross profit ■ rehabilitation expenses ■ product extortion demand
Extensions		Loss of gross profit Rehabilitation expenses	Adverse publicity Governmental recall

Table 2



Conclusion – keeping our food safe

Food safety is bound to emerge as a more pressing issue going forward. The reasons for this are several.

First and foremost, as middle classes in emerging markets expand they will become more aware and informed of their rights and more demanding in seeing these addressed, if growing evidence on social media is anything to go by.

Second, sensitivity to food contamination will trouble growing sections of populations worldwide, because our societies are ageing and allergies are on the rise. Both factors increase the likelihood of being affected by unsafe or mislabelled food.

Third a burgeoning world population cannot afford to keep wasting food on the scale seen today. Squandering away food because it is not safe to eat will become less acceptable as global pressure on resources keeps mounting.

A further consideration is that new food ingredients continue to come onto the market. Nanotechnology, nutraceuticals or functional food for instance are also turning up in food products. Labelling guidelines worldwide have become ever more complicated, and a wrong label can be sufficient grounds for a recall.

All these developments will challenge food producers in the future. Companies will need to devote more resources to risk management, improving quality assurance, developing a recall plan and preparing for crisis communication. These investments will go a long way to manage recalls.

Companies that have done this work also have access to insurance solutions to help them buffer the financial impact. There are product liability and product recall policies available to address the needs of any company, whatever its size and industry, from manufacturing and retail to hospitality.

To allow food producers to meet these challenges, Swiss Re works with insurers and the food industry worldwide to design market-adequate products based on our long-term loss data and global expertise in successful risk management schemes in the field.

The publication you just read is part of our know-how sharing with you. The food safety landscape will keep evolving, and with it, its risks and the solutions companies need to adapt to it. This is an ongoing conversation and we look forward to having it with you.

1 <http://www.fao.org/economic/ess/ess-fs/en/>
2 http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=35466
3 <http://www.efsa.europa.eu/en/press/news/120711.htm>
4 <http://www.cdc.gov/listeria/outbreaks/cantaloupes-jensen-farms/index.html>
5 <http://www.who.int/csr/media/faq/QAmelamine/en/>
6 http://europa.eu/rapid/press-release_PRES-11-253_en.htm
7 https://www.wto.org/english/res_e/statis_e/its2013_e/its13_highlights2_e.pdf
8 <http://www.efsa.europa.eu/en/press/news/120711.htm>
9 http://ec.europa.eu/food/safety/rasff/index_en.htm
10 <http://www.recalls.gov/>
11 <http://www.who.int/mediacentre/news/releases/2015/food-safety/en/>
12 <http://www.ers.usda.gov/data-products/cost-estimates-of-foodborne-illnesses.aspx#VDW27r4mUfy>
13 http://www.gmaonline.org/file-manager/images/gmapublications/Capturing_Recall_Costs_GMA_Whitepaper_FINAL.pdf
14 http://trade.gov/td/ocg/report08_processedfoods.pdf
15 <http://www.ers.usda.gov/topics/food-markets-prices/processing-marketing/manufacturing.aspx>
16 http://www.foodquality.com/details/article/4547111/The_Business_of_Recalls_From_Booming_to_Bankrupt.html?tzcheck=1
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Authors:

Daniel Knüsli, Roland Friedli, Jürg Busenhart

Research:

Irène Maag, Mario Fiasconaro

Editing and realisation:

Bernd Wilke

Managing Editor:

Urs Leimbacher

Proofreading:

Philippe Mettler

Infographics:

Annie Wu, Swiss Re Communications

Graphic design and production:

Swiss Re Corporate Real Estate & Logistics/
Media Production, Zurich

Photographs:

Getty Images, Swiss Re

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Swiss Reinsurance Company Ltd
Mythenquai 50/60
P.O. Box
8022 Zurich
Switzerland

Telephone +41 43 285 2121
Fax +41 43 285 2999
www.swissre.com