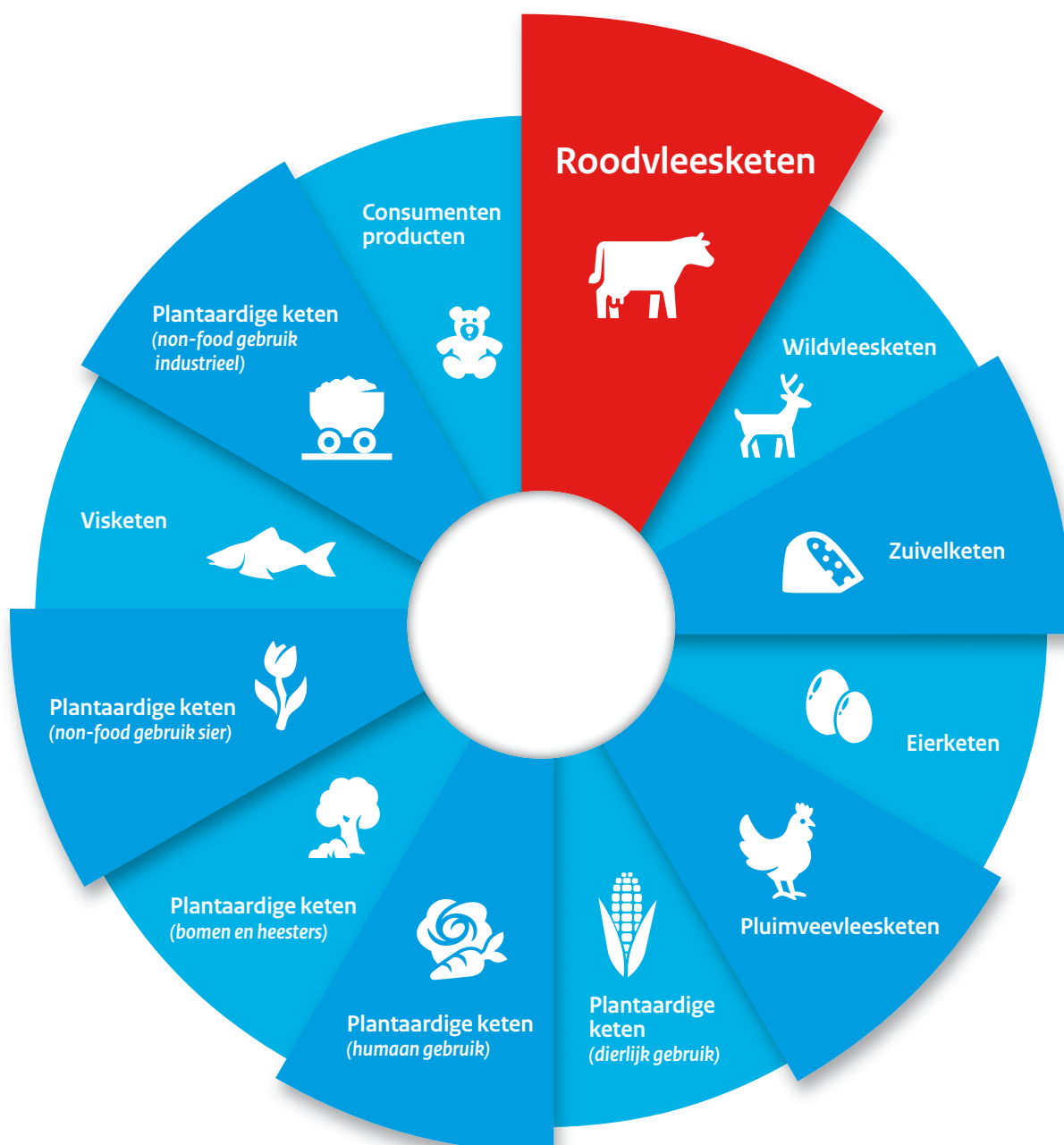




Netherlands Food and Consumer
Product Safety Authority
Ministry of Economic Affairs

Risk assessment of the red meat supply chain

Beef, pork, mutton, horse meat and goat meat





Contents

1	Foreword	3
2	Summary	4
3	Conclusions	8
3.1	Food safety conclusions	9
3.2	Animal welfare conclusions	10
4	Recommendations	13
5	Follow-up action by BuRO	14
6	Framework of the BuRO risk assessment	16
6.1	Background	16
6.2	Aims	17
6.3	Scope and focus	17
6.4	Approach	18
6.5	Assessment framework	19

2.

Foreword

This document contains an assessment of the risk associated with the red meat supply chain. It is the first in a series of supply chain assessments that the NVWA will be publishing in the period ahead. The supply chain assessment has been made by the NVWA's Office for Risk Assessment & Research (BuRO). It highlights the risks associated with the numerous links of the agricultural production chain, from the animal on the farm to the meat on the consumer's plate.

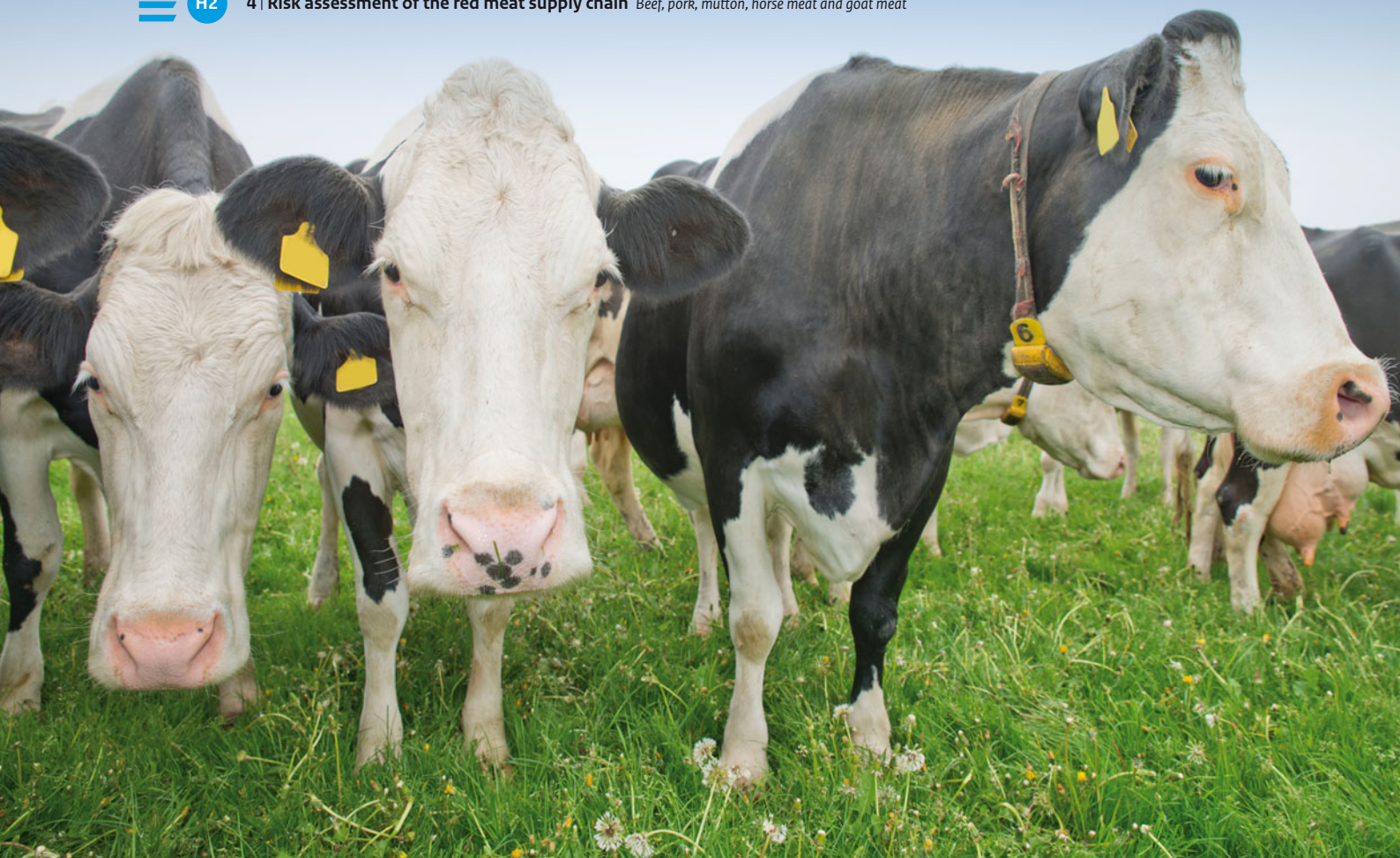
In the context of the NVWA Improvement Plan, we are currently working to make the organisation's activities more risk-focused and knowledge-driven. We are creating a new information and data infrastructure and implementing new data analysis techniques. Monitoring and focused research is yielding relevant knowledge that will shape later supply chain assessments. The supply chain assessments and analyses therefore form an essential basis for risk-focused and effective supervision. In combination with the priorities defined jointly by the NVWA and the Dutch parliament, the assessments facilitate good decision-making.

The supervisory activities of the Netherlands Food and Consumer Product Safety Authority (NVWA) play an important role in the protection of public interests. The Netherlands has an extensive system of legislation and regulations for establishing and maintaining high levels of plant and animal health, animal welfare, food and consumer product safety and ecological quality.

The NVWA monitors compliance with the legislation and regulations, intervenes where non-compliance is detected, and takes other initiatives to promote compliance. So, for example, the NVWA actively seeks to identify new risks, trends and developments in production and trade. It also develops new forms of supervision adapted to contemporary society. In addition, the NVWA draws the attention of policy-makers and politicians to areas in which the legislation and regulations are impractical or difficult to enforce, and to potential problems associated with gaps in the legislation and regulations. The NVWA's supervisory activities therefore serve to complete the policy cycle.

This risk assessment is important not only for the NVWA, but also for you. It will serve as a valuable resource for the formulation and revision of policy, legislation and regulations by government departments. It will additionally serve as a point of reference for everyone active in the supply chain – in other words, for all those who bear primary responsibility for the safety, health and welfare of people and animals.

Dr H. Paul MPA
Inspector General



2. Summary

In the Netherlands, more than twenty billion meals and snacks are eaten every year, many of them containing meat. The safety of the food involved is almost always effectively ensured by a variety of measures, by supervision and by appropriate behaviour on the part of businesses and consumers. Occasionally, though, something inevitably goes wrong. Problems arise about half a million times a year, or once in every forty thousand times that someone eats something. So the average consumer is affected once every thirty years.

Food safety standards are therefore very high and assured very effectively. Consequently, many food-related illnesses that were once relatively common, or remain relatively common in other countries, have been almost eradicated in the Netherlands. Maintenance of the high standards currently enjoyed in the Netherlands requires continuous attention to safety by food producers, consumers and supervisory authorities.

Any reduction in the focus on food safety is liable to lead quickly to a decline in standards. However, absolute food safety is unattainable. Most food safety problems manifest themselves in mild forms of food-borne infectious illness, such as nausea and diarrhoea lasting for a few days. Between one in a hundred and one in a thousand food infections results in more prolonged symptoms (lasting a few weeks) or a more serious form of illness. It is estimated that several hundred people a year suffer permanent food-related health impairment, while roughly eighty people die as a result of an (additional) infection contracted by consuming contaminated food. It is likely that half of the foods in question are meat

products. The people most at risk are the elderly and those with impaired immune system function. Meat and meat products appear to be responsible for just over half of the harmful effects of food, as measured in terms of mortality and Disability Adjusted Life Years (DALYs). Red meat (beef, pork, mutton, horse meat and goat meat) accounts for a considerable proportion of those effects. The chemical and physical risks are currently negligible: the threat to food safety comes almost exclusively from microbiological contaminants. The main sources of risk are the bacteria *Salmonella* and *Campylobacter*, with which red meat production animals can be infected in the farm stage of the red meat supply chain. The parasite *Toxoplasma gondii* and the bacterium STEC, both of which can be very dangerous, also enter the red meat supply chain in the farm stage, but cause much less disease in people. Nevertheless, *Toxoplasma gondii* makes a very considerable contribution to food safety risk in the Netherlands. Other food safety risks arise later in the red meat supply chain, as a result of the unhygienic processing of meat and meat products in the abattoir stage, the chilling and freezing stage and the preparation stage. The preparation and/or consumption of raw meat represent a particular threat to consumer health, due to the risk of cross-contamination. Meat that is thoroughly heated prior to consumption by frying, braising, stewing and/or boiling does not generally represent a risk. Thorough heating inactivates almost all microbiological agents that may have entered the supply chain at an earlier stage. There are exceptions, however: *Clostridium perfringens* is a spore-forming bacterium, which can rapidly proliferate in meat-containing hot foods and in meals that, after heating, are cooled for subsequent consumption too slowly. Fortunately, the effects of food infections caused by *Clostridium perfringens* are usually very mild.

It appears that all the species of livestock used for meat (cattle, pigs, horses, sheep and goats) contribute to disease burden to some extent. Imported meat and livestock potentially pose an additional risk, because imports are sometimes infected with pathogenic (i.e. disease-inducing) microorganisms that are rarely, if ever, encountered in the Netherlands any longer. Imported livestock and products may also bring new strains of familiar pathogens, such as *E. coli*, *Salmonella* and *Toxoplasma gondii*.

A large proportion of the microbiological contaminants found in the red meat supply chain originate from the production animals themselves. Like people, production animals are most likely to carry potentially pathogenic microorganisms on their skin and in their intestines. The extent to which such microorganisms find their way into the food supply chain depends on the levels of hygiene on the farms, during transportation and at the abattoir. Many businesses could reduce the prevalence of *Salmonella*, *Campylobacter* and *Toxoplasma gondii*, and thus improve hygiene, by implementing additional measures.

Hygienic abattoir procedures can minimise the risk of pathogenic microorganisms being transferred from the skin or intestines of slaughter animals to the meat obtained from them. In practice, however, the implementation of hygienic procedures can be challenging. Many abattoir processes are liable to result in meat being contaminated by contact with faeces or hair from the slaughter animal. Moreover, the risk of infection in the abattoir varies from one animal species to the next, because of anatomical differences. However, the microorganisms that are liable to infect meat are broadly the same in all animal species.

During chilling and freezing too, good hygiene can prevent additional risk. Insufficient or inappropriate hygiene and chilling procedures (prolonged storage of meat without freezing or chilling) can certainly lead to the introduction and proliferation of pathogenic microorganisms.

In the red meat supply chain, the abattoir forms a critical link between any pathogenic infection of the production animal in the primary stage and the tertiary stage (meat-on-the-plate stage), which should ideally be pathogen-free. It is important to stress that unhygienic procedures and poor storage can lead to the introduction or proliferation of pathogens (viruses, fungi, bacteria) in the post-abattoir tertiary stage of the meat supply chain. However, with exception of *Clostridium perfringens* proliferation, such issues are not specific to the meat supply chain, but inherent to the processing and preparation of foods in general.

Almost all microbiological contaminants found in the meat supply chain are present on the surface of the meat. The risk to the consumer therefore increases sharply as the surface-to-volume ratio of the meat increases. Hence, minced or ground meat, as used in burgers, meatballs and *filet américain*, presents a particular risk. Again, however, the risks can be minimised by heating the meat thoroughly. The biggest infection risk is associated with the consumption of raw meat, such as raw mince, *filet américain* and under-cooked burgers and sausages. Both specific microbiological contaminants from the primary production stage that are not eliminated in the secondary abattoir stage, and pathogens introduced during the secondary stage or tertiary consumption stage contribute to the risk.

It is also important that, all along the supply chain, the origin of the animal is clear. Meat from animals that have not been passed as fit for consumption, have been rejected as unfit for consumption or are of unknown origin represents a risk to public health. So too does fraudulently labelled meat or animal by-products.

The presence of chemicals in foods can in principle have adverse effects on consumer health. However, findings from the National Plan – a programme in which the presence of chemicals in production animals in the Netherlands is monitored – indicate that chemicals are found in slaughter animals only occasionally and in low concentrations. The substances in question are usually illegal growth-promoting agents and antibiotics, and sometimes environmental contaminants. The low concentrations involved and the sporadic nature of the potential exposure mean that such substances currently pose no risk to public health. Physical risks, e.g. arising from the presence of broken knife points in meat, are similarly rare. Hence, the public health risks associated with such hazards are in practice negligible.

The legal use of antibiotics in the red meat supply chain contributes to the development of antibiotic resistance in humans and therefore to the associated risks. Food safety can therefore be threatened, although the contribution of the red meat supply chain is currently minor. The Netherlands actively pursues policies aimed at further reducing such risks, e.g. the drastic reduction of antibiotic use. However, there is no guarantee that such policies will succeed, because the problem of antibiotic resistance may increase in the future, as a result of the selection of resistant microorganisms, despite the reduced use of antibiotics. In addition to food-borne pathogens, zoonoses transmitted via other routes (air, water, direct contact with animals) also constitute a potential public health risk. The implications for animal health and animal welfare need to be considered when seeking to drastically reduce antibiotic use in livestock farming. In many cases, however, animal disease can be further reduced by hygiene and animal welfare measures on the farm, thus enabling antibiotic use to be cut further.

BuRO's assessment is that, in the Netherlands, both food safety standards and production animal welfare standards are higher than in many other countries. The high standards of animal welfare result from measures implemented in the agricultural industry, from statutory provisions and from supervision. However, BuRO is not currently able to form a complete picture of the animal welfare risks associated with the red meat supply chain, due to the lack of systematic data registration in certain fields. Nevertheless, BuRO has formed the impression that further scope exists for securing improvement and reducing animal welfare risks.

The legal provisions that protect animal welfare in the Netherlands are based on EU regulations and are implemented in the Animals Act and the Animal Husbandry Decree. This latter decree makes a number of exceptions, however, which sometimes compromise realisation of its aims. Moreover, the decree is somewhat open in certain respects, meaning that compliance can be difficult to assess in practice. Partly as a result of those issues, the NVWA undertakes relatively little systematic registration of compliance levels. That is the case not only where the rules on the accommodation of farm animals and on animal neglect are concerned, but also where the rules on animal transportation and the Animals Act's animal welfare-related requirements regarding abattoir procedures are concerned.

Inadequate accommodation, care and management result in significant risks to the welfare of farm animals. Overcrowding and the mixing of animals from different groups can result in stress and aggressive behaviour. In very young animals, particularly cattle, the early separation of calves from their mothers can lead to abnormal suckling and other abnormal behaviour by the calf. In pigs, the absence of rooting material can similarly lead to abnormal behaviour. Failure to provide adequate feed and the provision of feed of an inadequate composition can also diminish animal welfare.

The optimisation of animal feed has animal health benefits, which translate into reduced animal welfare risks and increased natural resistance to disease amongst livestock. That in turn can contribute to further downward pressure on antibiotic use. Use of appropriate floors in farm buildings, coupled with good farm hygiene, can reduce the incidence of animals suffering wounds and/or infections. Respiratory infections and other animal diseases can also be controlled by good accommodation, e.g. with proper ventilation, and by not mixing animals from different groups.

Practices deleterious to the welfare of pigs continue in the Netherlands. They include docking pigs' tails and filing pigs' teeth to prevent the wounding of sows and the biting of the tails and ears of other animals in the same pen. The need for such measures can be largely removed by accommodating the animals in appropriate facilities and by putting down rooting material. The castration of male pigs without anaesthetic remains a regular occurrence. The animals suffer pain during and following the procedure, and their welfare is therefore adversely affected.

Like inadequate accommodation, transportation (including transfer to the abattoir) also involves animal welfare risks. Overcrowding of livestock trucks and the mixing of animals from different groups often cause stress, under the influence of which the animals are liable to wound each other.

Prior to slaughter, pigs are stunned using CO₂ or electric stunning devices. Cattle are stunned using captive bolt guns. Such techniques are not always correctly employed, resulting in unnecessary suffering. If inadequately stunned, a slaughter animal can regain consciousness before the slaughter process begins. The frequency of such occurrences and the extent of the associated animal welfare risks are unknown, because incidents are not recorded and scientific data are lacking.

In the Netherlands, some cattle, goats and sheep are slaughtered without stunning for religious reasons. Such practices cause stress and pain to the animals concerned. Cattle in particular exhibit much stronger reactions and increased resistance. Goats and sheep, which generally lose consciousness relatively quickly, react less and usually bleed to death quickly. Cattle remain conscious longer than sheep and goats because of anatomical differences in the vascular structures of the throat and head. Slow death is seriously detrimental to the welfare of slaughter animals.

The slaughter of cattle without stunning often involves the use of fixation equipment to invert the animals (turn them on their backs). The procedure triggers a serious stress reaction in the slaughter animal and therefore diminishes welfare immediately prior to slaughter. Pigs and horses are not slaughtered without stunning in the Netherlands.

For its assessment of animal welfare risks, BuRO has largely made use of information concerning the separate stages of the supply chain. However, it is also important to consider animals' whole life cycles. From birth, animals pass through all the stages of the supply chain described above and are exposed to welfare risks at all stages. The risks that individual animals of the same species actually experience vary considerably, depending on the practices of the farmers, traders, transporters and slaughterers.



3. Conclusions

This assessment of the red meat supply chain differs from a traditional risk assessment insofar as it considers all the various risks associated with the red meat supply chain, by reference to a single assessment framework. Naturally, the supply chain assessment reflects the many risks known to exist within the individual stages of the chain. It nevertheless provides a coherent overview of the highly diverse risks to food safety and animal welfare. That results in the observation that food safety can be enhanced not only by good procedural arrangements and hygiene measures in the abattoir stage and during the subsequent storage and processing of meat, but also by the implementation of hygiene measures in the primary stage (on the farm). Furthermore, it is apparent from the assessment that animal welfare risks are not always systematically monitored and by no means always systematically recorded. Information about such risks is consequently fragmented, making it difficult to establish which animals experience accumulations of welfare risks over the course of their lives.

As far as possible, this risk assessment seeks to determine whether the reduction of an individual risk is liable to influence the levels of other risks (risk migration).

BuRO believes that there is scope to further enhance both food safety and the welfare of red meat production animals (cattle, pigs, horses, sheep and goats) in the Netherlands. That assessment is based upon the situation that existed in 2013-2014, when the Safety Board (OVV) published its report *Risico's in de vleesketen* (Risks in the meat supply chain; 26 March 2014). Intended primarily for the State Secretary for Economic

Affairs and the Minister of Health, Welfare and Sport, the OVV's recommendations related mainly to the roles and responsibilities in the red meat supply chain that assure food safety, animal welfare and animal health.

As part of the *Verbeterplan Vlees* (Meat Improvement Plan), various changes have been made to the NVWA's supervisory activities since 2013. The changes have already reduced the risks to people and animals and are expected to yield further improvements in the future.

At the European level too, work is in progress with a view to revising the regulations on food safety, meat inspection, animal welfare and animal health in the red meat agricultural production chain. Implementation of the revised regulations is expected to help reduce the risks.

Finally, the cabinet is firmly committed to reducing the problems of antibiotic resistance associated with the use of antibiotics in livestock farming. The strong policies adopted are expected to bring about risk reductions. When framing the conclusions and recommendations contained in this report, BuRO has sought to avoid repeating points already highlighted in the context of the three campaigns and programmes described above.

BuRO's conclusions are set out in the following subsections. The conclusions are numbered sequentially, on the basis of the stages of the supply chain to which they relate. The numbering does not imply anything about the relative priority of the matters in question.

3.1 Food safety Conclusions

1. The food safety risks associated with the production and consumption of red meat currently stem almost exclusively from pathogenic microorganisms. The health effects involved nearly always consist of mild, temporary forms of illness. Fatal outcomes are very rare.
2. The human disease burden linked specifically to the red meat supply chain is largely attributable to pathogenic microorganisms of the genera *Toxoplasma gondii*, *Campylobacter*, *Salmonella* and *Clostridium perfringens*.
3. Further scope exists for supply chain-specific action to prevent the infection of meat by *Toxoplasma gondii*, *Campylobacter* and *Salmonella* in the primary stage, e.g. by tackling the introduction of *Salmonella* via infected animal feed on the farm.
4. Food safety risks associated with *Clostridium perfringens* can be addressed only in the final stages of the meat supply chain.
5. It appears that all the species of red meat production animal contribute to the disease burden attributable to pathogenic microorganisms.
6. The main additional risk associated with the importation of meat stems from the potential presence of pathogenic *E. coli* strains and parasites (*Toxoplasma gondii* in cattle), particularly strains not generally found in the EU.
7. Unhygienic procedures can result in bacteria and viruses infecting meat and meat products during slaughter and in all subsequent stages of the supply chain. The associated disease burden can be further reduced by the implementation of appropriate hygiene measures. However, the problem of unhygienic procedures is not specific to the red meat supply chain and also affects the processing and preparation of plant-based foods. Furthermore, improved abattoir procedures, particularly procedures designed to prevent faecal contamination and cross-infection, can reduce the incidence of meat infections.
8. Neither the storage of meat in chilling and freezing facilities nor the refrigerated transportation of meat leads to any significant increase in risk, provided that hygienic procedures are followed.

9. The chemical and physical food safety risks associated with the red meat supply chain are marginal and are generally controlled adequately. Although the existing system of monitoring, inspection and intervention provides reasonably effective risk control, it is important that there is no relaxation. It may be possible to make the system more efficient, however, by implementing the changes and improvements provided for in the National Plan.
10. The illegal use of antibiotics, growth-promoting agents and other veterinary pharmaceuticals can result in food safety risks. However, it is difficult to quantify the actual level of risk.
11. As indicated in the National Plan, the occasional presence in production animals of substances such as veterinary pharmaceuticals and contaminants in concentrations that contravene the regulations represents a very small food safety risk; the probability of health effects is small and the effects in question are minor.
12. Under the current circumstances, the administration of antibiotics to production animals represents a minor food safety risk. The development of antibiotic resistance in agriculture can contribute to the development of resistance problems in human health care, both by direct mechanisms involving zoonoses and by indirect mechanisms involving the transfer of resistance genes to human pathogenic microorganisms.
13. The implications for animal health and animal welfare need to be considered when seeking to reduce the administration of antibiotics to production animals, because reduced antibiotic use could result in a higher animal disease burden.
14. Meat of unknown origin, which may not have undergone inspection, can represent a food safety risk. Action to tackle fraud in the meat supply chain and an effective tracing system can help to control such risks. The food safety risks in question are likely to be small, however.
15. Food safety risks may potentially arise from fraud by which animal by-products that are unfit for human consumption, products whose 'best-before' dates have passed or meat from animals deemed unfit for human consumption enter the red meat supply chain. The actual risk is currently difficult to quantify; further analysis is required.
16. The reasons for the increasing incidence of infection by the Hepatitis E virus (HEV) in the Netherlands and other European countries are not known. Nor are data available regarding the current prevalence of HEV in the Dutch pig herd, or the prevalence of HEV in Dutch pork or pork products. There is also uncertainty surrounding the routes by which HEV can be transmitted to humans (meat, environment).
17. The approximate attribution of disease burden to specific pathogens is subject to scientific and practical limitations. Nevertheless, attribution could be improved in the years ahead if the NVWA continues working with partners in the Netherlands and other countries to develop and implement new methods and techniques.

3.2 Animal welfare conclusions

18. The infection of cattle by pathogenic microorganisms, in particular *Salmonella* and *E. coli* strains, can be controlled by reducing the extent to which the animals are in contact with their own manure.
19. The mixing of different age cohorts, overcrowding and poor ventilation in the sheds in which groups of veal calves are accommodated lead to health problems in young calves. Pulmonary infections and diarrhoea are the main causes of death amongst such animals in the first three months of their life.
20. Under the existing animal welfare legislation (Animals Act and Animal Husbandry Decree) exceptions are made from the requirements regarding the provision of rooting material (straw, hay, wood, sawdust) and nesting material for pregnant sows. As a result, the original objectives of the legislation are often not realised in practice.
21. The open nature of various provisions of the existing animal welfare legislation (articles 1.6 and 1.7 of the Animal Husbandry Decree) makes it difficult to determine whether an activity is compliant and therefore hinders effective supervision and enforcement.

22. It is not currently possible to properly assess the full extent of the animal welfare risks associated with the red meat supply chain because there is insufficient systematic registration of relevant parameters such as animal health and behaviour (cattle, pigs) and premature mortality (pigs) in animals in the various stages of the supply chain. Consequently, estimates of animal welfare risks involve considerable uncertainty.
23. Animal neglect does occur, resulting in animal welfare being diminished in various ways and to varying degrees. However, there is no clearly defined system for the registration of animal neglect, and no representative picture of the situation is therefore available.
24. No systematically compiled and reliable picture is available of the nature, frequency or seriousness of the animal welfare risks associated with livestock transportation.
25. Overcrowding of livestock trucks can increase the animal welfare risks associated with transportation. The effects on the animals concerned can be serious, and the probability of effects occurring increases sharply as the level of overcrowding rises.
26. Animals that are slaughtered without stunning (cattle, goats and sheep) experience stress and suffer pain during and after sticking.
27. Physiological and anatomical differences mean that cattle slaughtered without stunning remain conscious after sticking longer than sheep and goats do.
28. Because sheep and goats lose consciousness more quickly, they are less likely to experience additional suffering as a result of post-sticking abattoir procedures, providing that all such procedures conform to legal requirements.
29. When cattle are slaughtered without stunning, fixation and inversion of the animals to facilitate sticking causes additional suffering.
30. When cattle are slaughtered without stunning, there is a real danger that, after sticking, the animals do not lose consciousness within forty-five seconds. However, relevant scientific data and systematic records are lacking.
31. When cattle are slaughtered without stunning, fixation of the animals must continue for at least forty-five seconds after sticking (Animal Husbandry Decree, article 5.8). There is sometimes a misapprehension that subsequent slaughter procedures, as referred to in article 5.9, clause 2, may commence during the required fixation period. That is not the intention of the Animal Husbandry Decree, as the explanatory memorandum makes clear. The explanatory memorandum refers to European Regulation no. 1099/2009, which states that post-sticking procedures may not begin until there is no sign of life.

Pigs

32. Stunning pigs with CO₂ (or mixtures of CO₂, oxygen and nitrogen) prior to slaughter can cause the animals to suffer welfare problems (hyperventilation and dyspnoea) before losing consciousness. No systematically recorded data are available, however.
33. In 2014, an estimated one third of male piglets in the Netherlands were castrated. Depending on whether anaesthetic is used, the animals are liable to suffer pain both during and after the procedure.
34. Pigs that have no opportunity to root in straw or other suitable materials are liable to bite the tails and ears of other animals in the same pen, causing skin wounds.
35. Breeding sows and porkers can develop painful gastric abnormalities if their feed does not contain sufficient fibre. The provision of feed with an inadequate fibre content is possible because the Animal Husbandry Decree includes no quantitative requirements concerning feed composition.
36. Shortly before giving birth and when suckling, breeding sows are liable to suffer distress due to their movement being restricted, due to lack of opportunity to give expression to nesting and nursing instincts and due to skin wounds attributable to inadequate accommodation.
37. Tail docking and tooth filing still occur in pig farming and cause stress and pain to piglets.

Veal calves

38. The separation of calves from their mothers immediately after birth causes short-term welfare problems (stress) for the mothers and leads to the development of abnormal suckling behaviour in an estimated 5 per cent of calves, which are then liable to harm other animals in the same shed. The development of abnormal suckling behaviour can be controlled or even prevented by not separating calves from their mothers until the urge to suckle is superseded by the urge to ruminate (at the age of roughly three weeks).
39. Amongst veal calves kept in communal sheds, hard and smooth shed floors covered in urine and manure are associated with increased infection pressure and hoof problems and inhibit the expression of natural (playful) behaviour.
40. Young veal calves can suffer welfare and health problems if the feeding regime does not take proper account of their need to ruminate. Article 2.41 of the Animal Husbandry Decree, which sets out requirements regarding feeding regimes, takes insufficient account of the issue.



4. Recommendations

This risk assessment of the red meat supply chain is based upon the situation in the Netherlands. BuRO's recommendations relate mainly to the control of risks that actually arise in the Netherlands at the various stages of the red meat supply chain. They are therefore not included in this synopsis.



5. Follow-up action by BuRO

This report analyses and assesses a large number of food safety risks and animal welfare risks associated with the red meat supply chain. However, the red meat supply chain is made up of numerous component chains that are not individually addressed. Moreover, analysis of certain stages of the chain and certain risks is based on limited data. Further research is consequently required to support better assessment of the risks in certain fields. A second edition of the red meat supply chain assessment is scheduled for publication in 2018. In the intervening period, BuRO will investigate or commission the investigation of the following risks:

- Risks to domestic pets and other animals associated with the consumption of products from the slaughter of farm animals.
- Risks to animal health and food safety associated with agents in animal feed.
- Risks to food safety associated with animal by-products from the red meat supply chain and other meat supply chains.
- Risks in the hotel and catering industry associated with the consumption of red meat and other meat products.
- Risks associated with the industrial processing of (red) meat and meat products.
- Risks associated with the use of (illegal) veterinary pharmaceuticals, including antibiotics, in the red meat supply chain and other meat supply chains.

- Animal welfare risks within the red meat supply chain for production animals that, in the context of import and export activities, spend part of their lives in other countries.
- Risks associated with the production of manure in the red meat supply chain.

BuRO will follow up the findings of this supply chain assessment by investigating or commissioning the investigation of the following matters:

- The existing system of monitoring for chemical contamination in the meat supply chain (the National Plan). The National Plan is only partially risk-focused and could possibly be made more effective and efficient by the application of new scientific insights.
- The existing policy of zero tolerance of certain substances in animal and meat products. The policy is based on the precautionary principle and not always on sound toxicological scientific evidence.
- The minor red meat supply chains for horse meat, mutton and goat meat. It is desirable to clarify the similarities and differences between the microbiological contaminants found in these supply chains and those found in the pork and beef supply chains.
- Decontamination as a means of reducing microbiological contamination of meat and meat products. Decontamination can potentially contribute to the control of food safety risks, but must not be perceived as an alternative to good abattoir hygiene.
- Signs that pigs and cattle stunned using conventional methods may remain conscious or may have regained consciousness between stunning and slaughter.
- The indirect public health effects associated with the transfer of microorganisms from agriculture to the environment.
- The accumulation of animal welfare risks during the life cycle of slaughter animals in the supply chain between farm and abattoir.
- Classification and assessment of animal neglect reports on the basis of frequency, prevalence and seriousness.

Finally, BuRO is to perform a trend analysis of the red meat supply chain in conjunction with other meat supply chains. This analysis will tie in with the 2013 Government-wide Investigation of Trends. The findings will be published in 2016.



6. Framework of the BuRO risk assessment

6.1 Background

In 2012, the Netherlands Food and Consumer Product Safety Authority was formed by the merger of a number of government inspectorates. One of the aims of the merger was to unify the supervision of compliance with the various laws and regulations governing the production and sale of food and consumer products. Within the new framework, firm supervision of the red meat supply chain was envisaged, in line with the philosophy of risk-focused and knowledge-driven oversight. The intention was to realise an approach within which the supervision of animal health and animal welfare had equal status to the supervision of food safety. In 2012, when the ‘horse meat scandal’ surfaced in the Netherlands and elsewhere in Europe, it became painfully apparent that a risk-focused approach also needed to address fraud. Incidents, media reports and other pointers indicated that a fundamental analysis of the risks was necessary in order to promote public health, animal health and animal welfare and to tackle fraud.

From various reports, it was apparent that, after years of cost-cutting within the NVWA, food safety and animal welfare supervision and enforcement activities were under pressure in 2012 and the preceding years. That view was confirmed by the General Chamber of Audit's evaluation of the merger by which the NVWA was formed: *Toezicht bij de Nederlandse Voedsel- en Warenautoriteit na de fusie (Post-Merger Supervision by the Netherlands Food and Consumer Product Safety Authority*; 20 November 2013). The Safety Board's investigation of the horse meat scandal drew similar conclusions: *Risico's in de vleesketen (Risks in the Meat Supply Chain*; 26 March 2014). One important recommendation to come out of that investigation was addressed to the Inspector-General of the NVWA:

'Identify the risks that exist in vulnerable stages of the chain and define priorities. On the basis of a clear distinction between approval and supervision, maintain a close watch on enterprises to ensure that they fulfil their food safety responsibilities. Where investigation is required, seek cooperation with other investigative agencies.'

In 2013, in response to the horse meat scandal, the NVWA launched the Catena Project – the first step towards development and implementation of an alternative approach. The Catena Project involved mapping the various stages of the red meat supply chain and identification by BuRO of the risks that arise within each stage and within the supply chain as a whole. The aim of the project was to provide building blocks for the development of a supply chain-focused approach to risk assessment and enforcement. Within the Catena Project, proper account was taken of animal welfare and animal health. The project played an important part in the definition in 2014 of priorities for the NVWA's supervisory divisions in the context of the Red Meat Improvement Plan. Under the general NVWA Improvement Plan, which was introduced in 2014, numerous initiatives were taken with a view to helping the NVWA to exercise risk-focused and knowledge-driven oversight. The initiatives in question will be described in NVWA reports. As indicated, the Catena Project involved a preliminary analysis by BuRO of the risks associated with the red meat supply chain. The BuRO report now before you takes a closer look at the potential hazards and risks, and at the scientific evidence for them.

6.2 Aims

The aims of this assessment of the red meat supply chain are as follows:

1. To identify the food safety risks associated with the production of red meat
2. To identify the risks to the welfare of meat production animals.
3. To identify factors and practices that may influence the existing risks.
4. To recommend ways of controlling risks (more effectively).

6.3 Scope and focus

Many food safety recommendations mention meat, without distinguishing between red meat (beef, pork, horse meat, goat meat, mutton, large game) and poultry meat (chicken, turkey, guinea fowl, duck, quail and pheasant).

The NVWA and BuRO do distinguish, however. The report now before you concerns the red meat supply chain (excluding large game; see below). In the second quarter of 2016, a separate risk assessment will be published concerning the poultry meat supply chain.

This red meat risk assessment is concerned mainly with the supply chains under supervision in the Netherlands. As such, its scope is very limited in relation to the market reality. The importation and exportation of production animals and of meat and meat products are economically very significant activities. Important parts of the red meat supply chain are frequently realised in other countries.

Consequently, local circumstances and other factors may mean that the actual risks differ from those that are liable to arise in the Netherlands. This report does not address the risks arising in other countries, which BuRO intends to investigate in the future. The report does, however, consider the risks associated with imported animals and products.

Both animal health and public health are socially important themes, which are closely related through factors such as the problem of zoonoses (illnesses that can be passed from animals to humans). In this risk assessment, the animal health risks considered are exclusively those that are directly relevant to red meat production and food safety; the zoonotic animal disease risks considered are exclusively those that relate to the consumption of red meat. Hence, the potential risks of zoonoses being transferred to humans by infection mechanisms other than red meat consumption are outside the scope of this assessment. The NVWA will publish broader assessments of the risks that animal diseases pose for animals and humans elsewhere, e.g. in *Staat van de Diergezondheid (The State of Animal Health)* and, where cattle are concerned, in the dairy produce supply chain analysis.

Although this report is entitled *Risk assessment of the red meat supply chain*, it does not consider all forms of red meat emanating from the supply chain. The primary focus is risks that arise in the pork and beef supply chains, i.e. the main supply chains in the Netherlands. Less emphasis is placed on the horse meat, goat meat and mutton supply chains. That is partly for quantitative reasons (horse meat, mutton and goat meat are produced and traded in the Netherlands in much smaller quantities than pork and beef) and partly for qualitative reasons (reliable data regarding the horse meat, mutton and goat meat supply chains are relatively scarce). Additional research is required in order to provide further insight into the minor red meat supply chains. Consequently, a completely balanced analysis covering all types of red meat would have substantially extended the time required to produce this report. It is clear, however, that the food safety risks are fundamentally similar for all species of production animal. It is anticipated that, by the time that the next red meat supply chain analysis is produced in 2018, more information will be available regarding the horse meat, mutton and goat meat supply chains.

This report does not consider the large game supply chain. BuRO will publish a separate analysis of that supply chain towards the end of 2015. From 2018, the NVWA's periodic risk assessments of the red meat supply chain will cover the supply of both large game and meat from farm animals.

This analysis does not include the production of meat and meat products for consumption by pets and other animals, e.g. dogs and cats. Nor does it cover the complex supply chain for animal by-products. Those and other subjects, such as the hotel and catering industry and the industrial processing of animal products, will be addressed elsewhere. The very early stages of the supply chain will also be considered separately. Issues surrounding veterinary pharmaceuticals, including antibiotic use and the pharmaceutical contamination of other products, will be the focus of other reports, as will animal feed and raw materials and manure. The risks associated with keeping animals are also outside the scope of this report. Finally, it should be noted that the report does not consider the potential health risks faced by people whose diets involve the consumption of meat in unusually large quantities or the consumption of no meat at all. Such risks are likely to receive the attention of the RIVM within the next few years.

6.4 Approach

BuRO took the results of the Catena quick scan project as the starting point for a deeper risk assessment of the red meat supply chain, in which the food safety risks and animal welfare risks were systematically analysed. In its assessment, BuRO was guided by recent reports, particularly those published by the European Food Safety Agency (EFSA) – a network organisation in which all EU food authorities are represented. Knowledge is shared within the EFSA and in the context of bilateral agreements. In addition, BuRO undertook further wide-ranging scientific investigations. Wageningen University and Utrecht University were also commissioned to generate additional knowledge or review BuRO's own findings.

A multidisciplinary BuRO team headed by Chain Analysis Programme Leader J.A. Cornelese and Project Leader Dr B.H. ter Kuile produced a draft report. This draft report was submitted to five external experts in various disciplines for peer review. The NVWA divisions were also invited to suggest additions and highlight any factual inaccuracies.

In March 2015, BuRO presented the provisional conclusions of its red meat risk assessment and the associated recommendations to the IG and the NVWA chief inspectors, to enable them to formulate a prompt management response and a plan of approach. In May 2015, the provisional conclusions and recommendations were presented to the policy directorates of the Ministry of Economic Affairs and the Ministry of Health, Welfare and Sport. In the same month, the full text of the report, complete with supporting material, was sent to the Chief Inspectors of the NVWA's L&N, C&V and V&I divisions, and to the Staff Directorate and the policy departments at the Ministry of Economic Affairs and the Ministry of Health, Welfare and Sport to check the text for factual errors.

Following the assessment and processing of all input and feedback from the independent reviewers, and the correction of factual inaccuracies, a revised draft report was circulated to the NVWA divisions and the policy departments so that they were aware of the revisions made to the original draft. On 8 September, formal advance notice of the report's contents was given to the various ministers at the Ministry of Economic Affairs and the Ministry of Health, Welfare and Sport, as well as to the IG-NVWA. The report was adopted and signed by the Director of BuRO on 28 September 2015 and submitted to the IG-NVWA.

6.5 Assessment framework

The Office for Risk Assessment & Research performed its risk assessment of the red meat supply chain in accordance with the Independent VWA Risk Assessment Act. In that context, only two criteria are significant: scientific evidence and independence. BuRO designed and performed the risk assessment independently. Other organisational units within the NVWA were not permitted any input, except insofar as they were invited by BuRO on its own initiative to provide additional information. The policy departments at the Ministry of Economic Affairs and the Ministry of Health, Welfare and Sport were also asked to provide factual information. So, for example, information was in some cases required from the NVWA's supervisory divisions in order to estimate the actual level of exposure on the basis of monitoring data. BuRO did not consult any NVWA divisions or policy departments regarding interpretation of the data.

The recommendations contained in this report are intended to aid the risk management activities of the NVWA divisions and the policy departments at the Ministry of Economic Affairs and the Ministry of Health, Welfare and Sport. They reflect BuRO's assessment of the risks that exist; they do not reflect considerations such as ease of implementation and cost. Accounting for such considerations is an explicit element of risk management, not risk assessment.

In the context of this risk assessment, BuRO applies the definition of risk formulated by Rosa (Rosa, 1998), namely:

A situation or event in which something of human value (including humans themselves) has been put at stake and where the outcome is uncertain.

As indicated earlier, BuRO's assessment of the risks associated with the red meat supply chain is concerned with two things of human value: food safety and animal welfare. BuRO makes no judgement as to what is of most value; that is the role of society and political decision-makers. Of course, other things of human value are also at stake in the red meat supply chain, including honesty and trust. Those values are linked to fair trade, product integrity and fraud (the latter being the focus of the IOD risk assessment). Trade volume and product quality are of economic and social value as well. Hence, on the basis of Rosa's definition, it would have been justifiable to consider values other than those addressed by BuRO. Nevertheless, the analysis reported here is confined to factors that put at stake food safety or animal welfare.



Published by:

**Nederlandse Voedsel- en
Warenautoriteit**

Catharijnesingel 59
3511 GG Utrecht

Postbus 43006
3540 AA Utrecht
T (088) 223 33 33
F (088) 223 33 34

info@nvwa.nl
www.nvwa.nl

September 2015