CODEX ALIMENTARIUS COMMISSION

E

Food and Agriculture Organization of the United Nations

World Health Organization

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REP16/FH

JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX ALIMENTARIUS COMMISSION
Thirty-ninth Session
Rome, Italy
27 June – 01 July 2016

REPORT OF THE FORTY-SEVENTH SESSION OF THE CODEX COMMITTEE ON FOOD HYGIENE

Boston, Massachusetts, United States of America
9 – 13 November 2015

NOTE: *This report includes Circular Letter CL 2015/31-FH*

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CL 2015/31-FH

TO: Codex Contact Points
Interested International Organizations

FROM: The Secretariat
Codex Alimentarius Commission
Joint FAO/WHO Food Standards Programme
FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy

SUBJECT: **Distribution of the report of the Forty-seventh Session of the Codex Committee on Food Hygiene (REP16/FH)**

The report of the Forty-seventh Session of the Codex Committee on Food Hygiene (CCFH) will be considered by the 39th Session of the Codex Alimentarius Commission (Rome, Italy, 27 June - 01 July 2016).

MATTERS FOR ADOPTION BY THE CODEX ALIMENTARIUS COMMISSION:

Proposed Draft Standards and Related Texts at Steps 5/8 of the Procedure

1. Proposed Draft Guidelines for the Control of Non-typhoidal *Salmonella* spp. in Beef and Pork Meat (REP16/FH para. 22 and Appendix II);

2. Proposed Draft Guidelines on the Application of General Principles of Food Hygiene to the Control of Foodborne Parasites (REP14/FH para. 30 and Appendix III); and

3. Proposed Draft Annex I "Examples of Microbiological Criteria for Low-Moisture Foods when Deemed Appropriate in Accordance with the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997)" and Annex II "Guidance for the Establishment of Environmental Monitoring Programmes for *Salmonella* spp. and other Enterobacteriaceae in Low-Moisture Food Processing Areas" to the *Code of Hygienic Practice for Low-Moisture Foods* (CAC/RCP 75-2015) (REP16/FH para. 41 and Appendix IV).

Proposed Texts for adoption

4. Draft Annex III "Spices and Dried Aromatic Herbs" to the *Code of Hygienic Practice for Low-Moisture Foods* (CAC/RCP 75-2015) (REP16/FH para. 41 and Appendix IV).

Governments and international organizations wishing to comment on the above documents should do so in writing to the Secretariat, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy (e-mail: codex@fao.org) **before 31 May 2016.**

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SUMMARY AND CONCLUSIONS

The Forty-Seventh Session of the Codex Committee on Food Hygiene reached the following conclusions:

Matters for Adoption by CAC39

Forwarded the following texts for adoption at Step 5/8:

- Proposed draft Guidelines for the Control of Non-typhoidal *Salmonella* spp. in Beef and Pork Meat (para. 22 and Appendix II);
- Proposed draft Guidelines on the Application of General Principles of Food Hygiene to the Control of Foodborne Parasites (para. 30 and Appendix III);
- Proposed draft Annex I "Examples of Microbiological Criteria for Low-Moisture Foods When Deemed Appropriate in Accordance with the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997)" and Annex II "Guidance for the Establishment of Environmental Monitoring Programs for *Salmonella* spp. and other Enterobacteriaceae in Low-Moisture Food Processing Areas" to the *Code of Hygienic Practice for Low-Moisture* (para. 41 and Appendix IV).

Forwarded the following text for adoption:

- Proposed draft Annex III "Spices and Dried Aromatic Herbs" to the *Code of Hygienic Practice for Low-Moisture* (para. 41 and Appendix IV).

Matters for approval by CAC39

Forwarded the following text for revocation:

- *Code of Hygienic Practice for Spices and Dried Aromatic Herbs* (CAC/RCP 42-1995) (para. 40b).

Forwarded the following project documents for approval as new work:

- Revision of the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and it's HACCP Annex (para. 45(c) and Appendix V);
- Revision of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003) (para. 46(b) and Appendix VI).

Requests for FAO and WHO scientific advice

The Committee requested FAO and WHO scientific advice on:

- The use of clean, potable and other types of water in the *General Principles Food Hygiene* and other hygiene texts (para. 47);
- Verotoxigenic *E. coli* (VTEC) / Shiga toxigenic *E. coli* (STEC) (para. 49).

Matters Referred to other Committees

The Committee:

Committee on Fish and Fishery Products (CCFFP)

- Endorsed the provisions in the draft codes of practice on the processing of fish sauce and on processing of sturgeon caviar, as submitted by CCFFP24 (para. 5).

Committee on Spices and Culinary Herbs (CCSCH)

- Requested to clarify whether or not dried aromatic herbs encompass dried culinary herbs (para. 38(c)).

Other Matters for information

The Committee:

- Agreed to the amended Forward Workplan for the Committee (para. 52 and Appendix VII).

INTRODUCTION

1. The Codex Committee on Food Hygiene (CCFH) held its Forty-seventh Session in Boston, Massachusetts, the United States of America, from 9-13 November 2015, at the kind invitation of the Government of the United States of America. Dr Emilio Esteban of the United States of America Department of Agriculture, chaired the Session. The Session was attended by delegates representing 75 member countries, one member organization and nine international organizations. The list of participants, including FAO, WHO and the Secretariats, is given in Appendix I.

OPENING

2. Ms Mary Frances Lowe**,** U.S. Codex Manager USDA, opened the Session and extended her warmest welcome to all the participants. Mr Brian Ronholm, Deputy Undersecretary for Food Safety, USDA and Dr Susan Mayne, Director of CFSAN, FDA addressed the delegates. In their opening remarks they described their personal experiences that underscored their commitment to food safety. They recognized the importance of the work of the Committee in ensuring the health of consumers and fair practices in food trade.

Division of Competence[1]

3. The Committee noted the division of competence between the European Union and its Member States, according to paragraph 5, Rule II, of the Rules of Procedure of the Codex Alimentarius Commission, as presented in CRD1.

ADOPTION OF THE AGENDA (Agenda Item 1)[2]

4. The Committee adopted the Provisional Agenda as its Agenda for the Session.

MATTERS REFERRED BY THE CODEX ALIMENTARIUS COMMISSION AND/OR OTHER CODEX SUBSIDIARY BODIES TO THE FOOD HYGIENE COMMITTEE (Agenda Item 2)[3]

5. The Committee considered and noted the information in CX/FH 15/47/2, and endorsed the provisions in the draft codes of practice on the processing of fish sauce and on processing of sturgeon caviar, as submitted by the Committee on Fish and Fishery Products (CCFFP).

MATTERS ARISING FROM THE WORK OF FAO, WHO AND OTHER INTERNATIONAL INTERGOVERNMENTAL ORGANIZATIONS (Agenda Item 3)

Progress Report on the Joint FAO/WHO Expert Meetings on Microbiological Risk Assessment (JEMRA) and Related Matters (Agenda Item 3(a))[4]

6. The Representatives of FAO and WHO noted the information in CX/FH 15/47/3 on the scientific advice on: Control of Non-typhoidal *Salmonella* spp. in Beef and Pork and the Microbiological Safety of Lipid Based Ready to Use Foods for Management of Moderate and Severe Acute Malnutrition. They expressed appreciation to all the experts that had participated in this work and the Members who provided resources to support the work of JEMRA.

7. Noting the time required to develop scientific advice and the importance of having the reports of expert meetings available well in advance of CCFH sessions, the Representatives invited the Committee to consider requesting scientific advice as early as possible in the standard-setting process so as to provide adequate time and flexibility to respond to such requests.

8. The Representatives informed the Committee that a special volume of Food Control would be issued in December 2015 (volume 58) on the Development of Microbiological Criteria for Food, compiling example papers developed by working groups of the Committee.

9. With regard to antimicrobial resistance (AMR), recent discussions and developments at the international level were highlighted and the Committee was informed that CL 2015/21-CAC had been issued, requesting information on the status of implementation of the Codex texts on AMR and whether there was a need to update those texts, and/or request FAO, WHO and OIE to convene expert meetings to review any new scientific evidence.

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1 CRD1
2 CX/FH 15/47/1
3 CX/FH 15/47/2
4 CX/FH 15/47/3

10. Information on other related work, including the development of guidance for the establishment of shellfish sanitation systems, hazards associated with animal feed, histamine sampling tool, FAO guidance on risk-based meat inspection systems, whole-genome sequencing and the activities and forthcoming report of the WHO Foodborne Disease Burden Epidemiology Reference Group (FERG), were also shared.

11. The Committee expressed appreciation to FAO and WHO for their scientific advice, noting its importance for CCFH work.

Information from the World Organisation for Animal Health (OIE) (Agenda Item 3(b))[5]

12. The Observer of the World Organisation for Animal Health (OIE) addressed the Committee, underscoring the value of mutual participation by Codex and OIE in the other's standard-setting work and the need for coordination at the national level to ensure that the standards they developed would effectively cover the entire food-production continuum, where relevant.

13. The Observer informed the Committee that:

a) OIE Chapter 8.15. 'Infection with *Taenia solium*', adopted at the OIE General Session in May 2015, was included in the 2015 edition of the *Terrestrial Animal Health Code*.

b) OIE work continued on new standards on the prevention and control of *Salmonella* in pigs and cattle, in complement to Codex's new work on *Salmonella* in beef and pork and an expert *ad hoc* Group, which would meet in December 2015, will consider comments received.

c) The Code Commission would review the *ad hoc* Group report at its February 2016 meeting and expected to circulate the revised chapters for comments in its February 2016 meeting report.

14. OIE would continue to address relevant food safety-related issues as a high priority in its standard-setting work and to work closely with Codex and its committees to ensure the safe production of food of animal origin.

PROPOSED DRAFT GUIDELINES FOR THE CONTROL OF NONTYPHOIDAL *SALMONELLA* SPP. IN BEEF AND PORK MEAT (Agenda Item 4)[6]

15. The Delegation of the United States of America, as co-Chair with Denmark, summarized the CCFH work over the prior two years on the Guidelines, which addressed a major worldwide problem. The co-Chair recalled the contributions of two PWGs and two EWGs, and that FAO and WHO had conducted a systematic literature review to ensure that any relevant measures for the control of *Salmonella* in beef and pork had been identified, and convened an expert meeting to review the technical basis of the mitigation/intervention measures proposed by the May 2015 PWG.

16. The Committee noted the key points discussed and resolutions made by the PWG (CRD6), which had met immediately prior to and in parallel with the present session of CCFH, in particular: (i) the addition of ante-mortem inspection to the lairage step; (ii) the retention of the bacteriophage treatment as a GHP measure to reduce the bacterial load present on the animal prior to slaughter; and (iii) the addition of text to highlight the importance of feed withdrawal prior to slaughter.

17. The Committee agreed to base its discussion on the revised Guidelines prepared by the PWG (Annex to CRD6).

Specific comments

18. The Committee considered the revised Guidelines by section, noted comments, made editorial corrections and amendments for purposes of clarity, and took the following additional decisions:

a) *Annex I "Specific Control Measures for Beef"*

- *Table on Availability of Control Measures at Specific Steps in the Process Flow* – to change the note associated with step 9 Head Removal/Head Washing to indicate that the details of the measures could be found under step 8 Dehiding to take account of the fact that the carcass was already dehided at step 9.

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5 CX/FH 15/47/4

6 CX/FH 15/47/5; Revised proposed draft Guidelines for the Control of Non-typhoidal *Salmonella* spp. in Beef and Pork Meat – prepared by the United States of America and Denmark (CRD3); Report of PWG (CRD6); Comments of Argentina, Brazil, Canada, Colombia, Ecuador, Japan, Kenya, Niger, the African Union and IAEA (CX/FH 15/47/5 Add.1); European Union, Ghana, India, Mexico, Nigeria, Philippines, Senegal and Thailand (CX/FH 15/47/5 Add.2); Tanzania (CRD11); El Salvador (CRD13); Dominica (CRD14); Ecuador (CRD16); Dominican Republic (CRD19); Republic of Korea (CRD21).

- *Step 4 Lairage* – to include "ante-mortem inspection" in the name of the step, noting that ante-mortem inspection was likely to take place at lairage and that related information was already included in that step.

b) *Annex II "Specific Control Measures for Pork"*

- to reflect several changes made in the Annex for Beef, for consistency.
- *Step 6 Sticking/Bleeding* – to delete the paragraph on initial measures to prevent contamination of the carcass during the initial cut to take account of the fact that they were not relevant.

Conclusion

19. The Committee, noting that all comments had been addressed and no outstanding issues remained, agreed that the document was ready to progress in the Step Procedure.

20. In response to a question on the need for FAO/WHO to develop modelling tools to support the implementation of risk-based control measures for *Salmonella* in beef and pork, the representative of FAO cautioned against rushing into the development of such tools. Based on past experience with tools for *Salmonella* and *Campylobacter* in poultry, she noted that countries might require a range of resources to support implementation of such guidelines, including modelling tools; as countries become more familiar with the guidelines, it would be useful to identify the real needs of countries and use this to guide the development of appropriate support.

21. The Representative also reminded the Committee that all references and materials used to develop the guidelines had been captured in the Annex of the report of the FAO/WHO Expert Meeting, to be issued in early 2016.

Status of the Proposed Draft Guidelines for the Control of Non-typhoidal *Salmonella* spp. in Beef and Pork Meat (N02-2014)

22. The Committee agreed to forward the proposed draft Guidelines for adoption at Step 5/8 (with omission of Steps 6/7) by the Codex Alimentarius Commission (Appendix II).

23. The Delegation of the Dominican Republic expressed their reservation to this decision on the grounds that further time was required to consider the revised document.

PROPOSED DRAFT GUIDELINES ON THE APPLICATION OF GENERAL PRINCIPLES OF FOOD HYGIENE TO THE CONTROL OF FOODBORNE PARASITES (Agenda Item 5)[7]

24. The Delegation of Japan, as co-Chair with Canada, summarized the CCFH work on the Guidelines, which had involved three PWGs and two EWGs. The document followed the format of the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and the section on Primary Production had been divided into four sub-sections – (i) meat and meat products, (ii) milk and milk products, (iii) fish and fishery products, and (iv) fresh fruits and vegetables, because these product categories required specific control measures.

25. The co-Chair further summarized the work of the PWG (CRD5), which had met immediately prior to the CCFH, and highlighted the key issues discussed and revisions made to the document.

26. The Committee agreed to base its discussion on the revised Guidelines prepared by the PWG (CRD5, Annex).

Specific comments

27. The Committee considered the revised Guidelines by section, noted comments, made editorial corrections and amendments for purposes of clarity and took the following additional decisions:

a) *2.2 Use* – to delete references to the *Guidelines for the control of Trichinella spp. in meat of Suidae* (CAC/GL 86-2015) and *Guidelines for the control of Taenia saginata in meat of domestic cattle* (CAC/GL 85-2014), on the understanding that a proposal for the compilation of all texts related to foodborne parasites would be considered at the next session of the CCFH.

[7] CX/FH 15/47/6; Revised proposed draft Guidelines on the Application of General Principles of Food Hygiene to the Control of Foodborne Parasites – prepared by Japan and Canada (CRD2); Report of the PWG (CRD5); Comments of Argentina, Brazil, Colombia, Costa Rica, El Salvador, Iran, Japan, Kenya, Saint Lucia, Switzerland, United States of America, African Union, CEFIC, FoodDrinkEurope (CX/FH 15/47/6 Add.1); European Union, Ghana, India, Mali, Mexico, Nigeria, Philippines, Senegal, Thailand and IDF (CX/FH 15/47/6 Add.2); Tanzania (CRD11); Dominica (CRD14); Indonesia (CRD15); Ecuador (CRD16); Dominican Republic (CRD19).

b) *2.3 Definitions* – to reinsert the definition of "larvae", as the term appeared several times in the document, and to insert an explanatory note to the term "intermediate host" where it occurred for the first time in the document.

c) *3. Primary Production* – to rearrange the order of the examples of important foodborne parasites to reflect the ranking assigned by the FAO/WHO Expert Meeting[8] in the introductory paragraphs of the four categories of products.

d) *3.A Meat and Meat Products*

- *Environmental Hygiene* – to agree to the text in Option 2, as it contained greater detail, but to delete the sentence regarding unsuitable areas because the exclusion of areas where controls of foodborne parasites could not be applied at primary production and at later stages appeared disproportionately strict.
- *Hygienic Production of Food Sources* – to delete the paragraph on the exclusion of domestic and wild animals and unauthorized persons from barns and outdoor areas because it was very difficult to apply, and, consequently, to retain the example of *Toxoplasma* in the subsequent paragraph.
- *Cleaning, Maintenance and Personnel Hygiene at Primary Production* – to delete the reference to Section 11 of the *Code of Hygienic Practice for Meat* because it was not relevant to primary production; to add an example of adequate means of hygienic washing in the paragraph regarding on-farm sanitary facilities; and to move the entire paragraph to the introductory section on Primary Production since it applied to all four categories of products.

e) *3.B Milk and Milk Products*

- *Environmental Hygiene* – to delete the measure not allowing dairy herds to graze in areas where Felidae were found as such a measure was impracticable and disproportionate to the risk.

f) *3. C Fish and Fishery Products*

- *Environmental Hygiene* – to add a degree of flexibility to the measure concerning the disposal of material derived from on-board evisceration and to amend the example of an aquaculture method that may reduce the parasite hazards to reflect that no anisakid worms had been observed in ocean pen-reared salmon raised on commercial pelleted feed.
- *Hygienic Production of Food Sources* – to delete the example of placing fences around ponds as it was not practical.
- *Monitoring and Surveillance at Primary Production* – to delete the example of the use of candling tables as it was not appropriate.

g) *5.1 Control of Food Hazards* – to delete the paragraph on newer technologies on account of its generic nature, failure to add any specific value to the document, and the aspects related to validation and approval being sufficiently covered.

h) *5.2.2.1 Freezing* – to delete the details regarding the inactivation of *T. nativa* and *T. bitovi.*

i) *5.2.2.5 Washing* – to revise the paragraph to refer to Section 5.2.2.1 of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003), which provided guidance on the types of water used for washing.

j) *10 Training* – to amend the paragraph to indicate that training for the control of parasites was also important for all food handlers of ready-to-eat foods.

Conclusion

28. The Committee, noting that all comments had been addressed and no outstanding issues remained, agreed that the document was ready to progress in the Step Procedure.

29. So as to compile all guidance for the control of foodborne parasites into a single document, the Committee agreed to request the Codex Secretariat to prepare a proposal for merging the Guidelines with the *Guidelines for the control of Trichinella spp. in meat of Suidae* (CAC/GL 86-2015) and the *Guidelines for the control of Taenia saginata in meat of domestic cattle* (CAC/GL 85-2014) for consideration at its next session.

[8] http://www.fao.org/3/a-i3649e.pdf and http://www.who.int/foodsafety/publications/mra_23/en/

Status of the Proposed Draft Guidelines on the Application of General Principles of Food Hygiene to the Control of Foodborne Parasites (N03-2014)

30. The Committee agreed to forward the proposed draft Guidelines for adoption at Step 5/8 (with omission of Steps 6/7) by the Codex Alimentarius Commission (Appendix III).

PROPOSED DRAFT ANNEXES TO THE CODE OF HYGIENIC PRACTICE FOR LOW-MOISTURE FOODS (Agenda Item 6)[9]

31. The Delegation of Canada, as co-Chair with the United States of America, introduced this item and reported that the EWG, pursuant to the mandate given to it by CCFH46, had: (i) developed six annexes (examples of microbiological criteria for low-moisture foods, guidance for the establishment of environmental monitoring programmes, and four commodity-specific annexes); and (ii) determined that there was no need for additional scientific advice.

32. The co-Chair noting the limited guidance provided in the annexes on desiccated coconut, dried fruits and dehydrated fruits and vegetables, proposed that the work on these annexes be discontinued and that the corresponding codes of hygienic practice be considered for future revision.

33. The co-Chairs informed the Committee that, based on the comments submitted, they had prepared revised Annexes (CRD7 Rev) and explained the changes introduced. The Committee agreed to base its discussion on CRD7 Rev.

General comments

34. The Committee agreed to discontinue consideration of Annexes IV, V and VI on account of the limited guidance they contained, and to continue the discussion on Annexes I, II and III.

35. The Delegation of the European Union expressed reservations regarding the provision of examples of microbiological criteria for low-moisture foods as an Annex to the *Code of Hygienic Practice for Low-Moisture Foods* since their relatively low risk, compared to other foods, did not justify microbiological criteria. In their view such criteria would put a disproportionate burden on producers; guidance on good hygiene practices sufficed. Introducing such criteria was considered against the Codex principle of prioritising standards for the most important hazards, but the European Union would, in the spirit of compromise, accept their inclusion as example in an annex.

36. The Delegation of Colombia expressed their concern regarding the retention of Annex I (Examples of microbiological criteria) as it was the prerogative of each country to develop its own microbiological criteria.

37. The Committee noted that the text emphasized that the criteria were examples and were not applicable in all cases.

Specific comments

38. The Committee considered the Annexes I, II and III by section, noted comments, made editorial corrections and amendments for purposes of clarity and took the following additional decisions:

a) *Annex I* – to provide examples of susceptible populations.

b) *Annex II, Paragraph 3* – to delete the final sentence of paragraph 3, since paragraph 5b provided sufficient guidance on sample sites.

c) *Annex III* – to agree to request the Committee on Spices and Culinary Herbs (CCSCH) to clarify whether or not dried aromatic herbs encompassed dried culinary herbs, noting that sections on hygiene in standards being developed by CCSCH for culinary herbs would reference the *Code of Hygienic Practice for Low-Moisture Foods* and, in particular, its annex on spices and dried aromatic herbs.

Conclusion

39. The Committee, noting that all comments had been addressed and no outstanding issues remained, agreed that the annexes were ready to progress in the Step Procedure.

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[9] CX/FH 15/47/7; Revised proposed draft Annexes to the Code of Hygienic Practice for Low-Moisture Foods – prepared by Canada and the United States of America (CRD7rev); Comments of Argentina, Brazil, Ecuador, El Salvador, Japan, Kenya, Mexico, Paraguay, Saint Lucia and FoodDrinkEurope (CX/FH 15/47/7 Add.1); Colombia, Ghana, Iran, Mali, Nigeria, Philippines, Senegal, Thailand and African Union (CX/FH 15/47/7 Add.2); Tanzania (CRD11); Dominica (CRD14); Indonesia (CRD15); Ecuador (CRD16); India (CRD17); Dominican Republic (CRD19).

40. The Committee agreed to:

a) Request that the Commission revoke the *Code of Hygienic Practice for Spices and Dried Aromatic Herbs* (CAC/RCP 42–1995) on account of its inclusion as an Annex to the *Code of Hygienic Practice for Low-Moisture Foods*;

b) Retain the *Codes of Hygienic Practice for Groundnuts (Peanuts)* (CAC/RCP 22-1979), *Desiccated Coconut* (CAC/RCP 4-1971), *Dried Fruits* (CAC/RCP 3-1969), *Dehydrated Fruits and Vegetables including Edible Fungi* (CAC/RCP 5-1971) and *Tree Nuts* (CAC/RCP 6-1972) and consider updating them in the future; and

c) Request CCSCH to clarify whether or not dried aromatic herbs encompassed dried culinary herbs.

Status of the Proposed Draft Annexes to the Code of Hygienic Practice for Low-Moisture Foods (N06-2013)

41. The Committee agreed to forward the proposed draft Annexes I and II for adoption at Step 5/8 (with omission of Steps 6/7) and Annex III for adoption by the Codex Alimentarius Commission (Appendix IV).

DISCUSSION PAPER ON THE NEED TO REVISE THE *CODE OF HYGIENIC PRACTICE FOR FRESH FRUITS AND VEGETABLES* (CAC/RCP 53-2003) (Agenda Item 7)[10]

DISCUSSION PAPER ON THE REVISION OF THE *GENERAL PRINCIPLES OF FOOD HYGIENE* (CAC/RCP 1-1969) AND IT'S HACCP ANNEX (Agenda Item 8)[11]

42. The Committee noted that the proposals for new work made by the EWG on revision of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (Agenda Item 7) and revision of the *General Principles of Food Hygiene* and its HACCP annex (Agenda Item 8) had been discussed in the PWG for establishment of CCFH work priorities and would be further considered under Agenda Item 9.

OTHER BUSINESS AND FUTURE WORK (Agenda Item 9)[12]

(a) New Work

43. The Delegation of the United States of America, Chair of the PWG for establishment of CCFH work priorities, which had met immediately prior to the present session, introduced the report (CRD4) and gave an overview of the discussions and recommendations.

44. The Committee considered the recommendations of the PWG and took the following decisions.

Revision of the *General Principles of Food Hygiene* (CAC/RCP 1–1969) and its HACCP Annex

45. The Committee agreed to:

a) Start new work on the revision of the *General Principles of Food Hygiene* and its HACCP annex;

b) Amend the project document to indicate that managerial aspects were not within the scope of the work;

c) Submit the project document to the Codex Alimentarius Commission for approval as new work (Appendix V);

d) Establish an EWG, chaired by France and co-chaired by Chile, Ghana, India and the United States of America, working in English, Spanish and French to prepare the proposed draft revision of the *General Principles* for circulation for comments at Step 3 and consideration at the next session of the Committee; and

e) Consider convening a PWG, working in English, French and Spanish, at the next session to prepare a revised proposal on the basis of the comments submitted.

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[10] CX/FH 15/47/8; Comments of El Salvador, Ghana, Malaysia, Mali, Nigeria, Senegal, Tanzania and African Union (CRD8); Ecuador (CRD16); Dominican Republic (CRD19).

[11] CX/FH 15/47/9; Information from ISO (CRD12); Information from FAO/WHO (CRD18); Comments of El Salvador, Ghana, India, Malaysia, Mali, Nigeria, Philippines, Senegal, Tanzania, Thailand and African Union (CRD9); Ecuador (CRD16);); Dominican Republic (CRD19).

[12] CL 2015/17-FH; CX/FH 15/47/10; Report of PWG (CRD4); Comments of El Salvador, India, Mali and Thailand (CRD10); project document for revision of the *General Principles of Food Hygiene* and its HACCP annex (CRD20); and project document for revision of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CRD22).

Revision of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003)

46. The Committee agreed to:

a) Start new work on the revision of the *Code of Hygienic Practice for Fresh Fruits and Vegetables*;

b) Submit the project document to the Codex Alimentarius Commission for approval as new work (Appendix VI); and

c) Establish an EWG, co-chaired by Brazil and France, and working in English only, to prepare the revised proposed draft Code for circulation for comments at Step 3 and consideration at the next session of the Committee.

(b) Request for Scientific Advice

Scientific advice to help clarify the use of clean, potable and other types of water in the *General Principles of Food Hygiene* and other hygiene texts

47. The Committee agreed to request FAO and WHO to:

a) Undertake a review of the existing FAO and WHO guidelines and related texts on water and water quality to determine whether they cover all aspects of water use relevant to food production and processing. This includes water used in primary production (including use of recycled and waste water), water in contact with food or used as an ingredient and water used in enclosed systems in food operations (e.g. heating, cooling).

b) Identify any gaps in the existing FAO and WHO water related guidelines.

Verotoxigenic *E. coli* (VTEC) / Shiga toxigenic *E. coli (STEC)*

48. The Committee noted that VTEC/STEC had been discussed at several recent sessions and work on the issue was among the top priorities in its Forward Workplan. The Committee, therefore, agreed that it was an important issue to address.

49. To support its work in this area and pursuant to the request from FAO and WHO for more time to develop scientific advice, the Committee agreed to request FAO and WHO to develop a report compiling and synthesizing the information available, using existing reviews, on the following aspects of VTECs/STECs:

a) The global burden of disease attribution based on outbreak data, incorporating information from the FERG as appropriate;

b) Hazard identification and characterization of VTECs/STECs, including information on genetic profiles and virulence; and

c) Current monitoring and assurance programmes including the status of the currently available methodology (commercially available and validated for regulatory purposes) for monitoring of VTECs/STECs in food as a basis for management and control.

50. To facilitate addressing a number of aspects of this work a call for data would need to be issued and feedback from countries would be critical.

51. The Committee noted that the nature and content of the work to be undertaken by CCFH, including the commodities to be focused on, would be determined based on the outputs of above.

(c) Forward Workplan and Process by which the Committee on Food Hygiene (CCFH) will Undertake its Work

52. The Committee agreed to the amended Forward Workplan (Appendix VII).

53. Noting that the Forward Plan included development of annexes on tomatoes and carrots to the *Code of Hygienic Practice for Fresh Fruits and Vegetables*, the Committee agreed to request the EWG (para. 46c) to consider whether there was a need or not for these annexes.

54. In accordance with the process by which CCFH undertakes its work, the Committee also agreed to:

a) Request the Secretariat to issue a Circular Letter requesting proposals for new work; and

b) Establish the PWG on CCFH Work Priorities, which will meet at CCFH48 and work in English, French and Spanish, chaired by the United States of America.

(d) Other business

55. The Delegation of Argentina noted the importance to translate “should” as “debería” and not as “debe” in the Spanish version of Codex documents.

DATE AND PLACE OF THE NEXT SESSION (Agenda Item 10)

56. The Committee was informed that CCFH48 was tentatively scheduled on 7–11 November 2016, in Los Angeles, California, United States of America.

SUMMARY STATUS OF WORK

Subject Matter	Step	Action by:	Reference in REP16FH
Guidelines for the Control of Non-typhoidal *Salmonella* spp. in Beef and Pork Meat	5/8	Governments CAC39	Para. 22 and Appendix II
Guidelines on the Application of General Principles of Food Hygiene to the Control of Foodborne Parasites	5/8	Governments CAC39	Para. 30 and Appendix III
Proposed Draft Annex I "Examples of Microbiological Criteria for Low-Moisture Foods when Deemed Appropriate in Accordance with the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997)" and Annex II "Guidance for the Establishment of Environmental Monitoring Programmes for *Salmonella* spp. and other Enterobacteriaceae in Low-Moisture Food Processing Areas" to the *Code of Hygienic Practice for Low-Moisture Foods* (CAC/RCP 75-2015)	5/8	Governments CAC39	Para. 41 and Appendix IV
Draft Annex III "Spices and Dried Aromatic Herbs" to the *Code of Hygienic Practice for Low-Moisture Foods* (CAC/RCP 75-2015)	-	Governments CAC39	Para. 41 and Appendix IV
New Work			
Revision of the *General Principles of Food Hygiene (*CAC/RCP 1-1969) and its HACCP Annex	2,3	CAC39 Electronic Working Group (France and Chile, Ghana, India, United States of America) CCFH48	Para. 45(c) and Appendix V
Revision of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003)	2,3	CAC39 Electronic Working Group (Brazil and France) CCFH48	Para. 46(b) and Appendix VI
New work proposals / Forward Workplan	-	Governments Physical Working Group (United States of America) CCFH48	Para. 54 and Appendix VII

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Appendix II

PROPOSED DRAFT GUIDELINES FOR THE CONTROL OF NONTYPHOIDAL *SALMONELLA* SPP. IN BEEF AND PORK MEAT

(N02-2014)

(at Step 5/8)

1. INTRODUCTION

1. Salmonellosis is one of the most frequently reported foodborne diseases worldwide, with beef and pork meat considered important food vehicles. The burden of the disease and the cost of control measures are significant in many countries and contamination with zoonotic nontyphoidal *Salmonella*[1] has the potential to disrupt trade between countries.

2. The large degree of variation exhibited by *Salmonella* in their biological properties, host preferences, and environmental survival presents a particular challenge for controlling the presence of *Salmonella* in animal production. In practice, this means that there is no "one size fits all" solution, and different production systems may require different approaches to control the various serovars of *Salmonella*.

3. These Guidelines apply a risk management framework (RMF) approach as advocated in *Principles and Guidelines for the* Conduct *of Microbiological Risk Management (MRM)* (CAC/GL 63-2007). "Preliminary Risk Management Activities" and "Identification and Selection of Risk Management Options" are represented by the guidance developed for control measures at each step in the food chain. The following sections on "Implementation" and "Monitoring" complete the application of all the components of the RMF.

4. The Guidelines build on general food hygiene provisions already established in the Codex system and propose potential control measures specific for *Salmonella* strains of public health relevance in beef and pork meat. In this context, the Codex Alimentarius Commission (CAC) is committed to develop standards that are based on sound science[2]. Potential control measures for application at single or multiple steps of the food chain are presented in the following categories:

- Good hygienic practice (GHP) – based: They are generally qualitative in nature and are based on empirical scientific knowledge and experience. They are usually prescriptive and may differ among countries.
- Hazard – based: They are developed from scientific knowledge of the likely level of control of a hazard at a step (or series of steps) in a food chain. They are based on a quantitative base estimate in the prevalence and/or concentration of *Salmonella,* and can be validated as to their efficacy in hazard control at a specific step. The benefit of a hazard-based measure cannot be exactly determined without a specific risk assessment; however, any significant reduction in pathogen prevalence and / or concentration is expected to provide a certain level of human health benefit.

5. Examples of control measures that are based on quantitative levels of hazard control have been subjected to a rigorous scientific evaluation in development of the Guidelines. Such examples are illustrative only and their use and approval may vary amongst member countries. Their inclusion in the Guidelines illustrates the value of a quantitative approach to hazard reduction throughout the food chain.

6. The Guidelines are presented in a flow diagram format so as to enhance practical application of a primary production-to-consumption approach to food safety.

7. This format:

- Demonstrates the range of the approaches of control measures for *Salmonella.*
- Illustrates relationships between control measures applied at different steps in the food chain.
- Highlights data gaps in terms of scientific justification / validation for control measures.
- Facilitates development of hazard analysis and critical control points (HACCP) plans at individual establishments and at national levels.

[1] Human pathogens of public health relevance only. For the purposes of this document, all references to *Salmonella* relate only to human pathogens.

[2] Strategic Goal 2 of the Strategic Plan of the Codex Alimentarius Commission is to "Ensure the application of risk analysis principles in the development of Codex standards" and the CAC Procedural Manual states that "Health and safety aspects of Codex decisions and recommendations should be based on a risk assessment, as appropriate to the circumstances" – 23rd Edition, page 218.

- Assists in judging the equivalence[3] of control measures for beef and pork meat applied in different countries.
- Illustrates the interdependent relationship between Codex guidelines and OIE standards throughout the food chain. These Guidelines do not deal with matters of animal health unless directly related to food safety or suitability.

8. In doing so, the Guidelines provide flexibility for use at the national (and individual processing) level.

2. OBJECTIVES

9. These Guidelines provide information to governments and industry on the control of nontyphoidal *Salmonella* in beef and pork meat that aim to reduce foodborne disease whilst ensuring fair practices in the international food trade. The Guidelines provide a scientifically sound international tool for robust application of GHP- and hazard-based approaches for control of *Salmonella* in beef and pork meat according to national risk management decisions. The control measures that are selected can vary between countries and production systems.

10. The Guidelines do not set quantitative limits for *Salmonella* in beef and pork meat in international trade. Rather, the Guidelines follow the example of the overarching *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005) and provide an "enabling" framework which countries can utilize to establish control measures appropriate to their national situation.

3. SCOPE AND USE OF THE GUIDELINES

3.1. Scope

11. These Guidelines are applicable to all nontyphoidal *Salmonella* that may contaminate beef and pork meat and cause foodborne disease. The primary focus is to provide information on practices that may be used to prevent, reduce, or eliminate nontyphoidal *Salmonella* in fresh[4] beef and pork meat. Other measures, in addition to those described here, may be needed to control *Salmonella* in offal.

12. These Guidelines in conjunction with the relevant OIE standards can apply from primary production-to-consumption for beef and pork meat produced in commercial production systems.

3.2. Use

13. The Guidelines provide specific guidance for control of nontyphoidal *Salmonella* in beef and pork meat according to a primary production-to-consumption food chain approach, with potential control measures being considered at each step, or group of steps, in the process flow. The Guidelines are supplementary to and should be used in conjunction with the *General Principles of Food Hygiene* (CAC/RCP 1–1969), the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005), the *Code of Practice for Animal Feed* (CAC/RCP 54-2004) and the *Guidelines to the Validation of Food Safety Control Measures* (CAC/GL 69-2008).

14. These general and overarching provisions are referenced as appropriate and their content is not duplicated in these Guidelines.

15. The primary production section of these Guidelines is supplementary to and should be used in conjunction with relevant chapters of the OIE *Terrestrial Animal Health Code*[5].

16. The Guidelines systematically present GHP-based control measures. GHPs are pre-requisites to making choices on hazard-based control measures. Hazard-based measures will likely vary at the national level and therefore these Guidelines only provide examples of hazard-based controls. Examples of hazard-based control measures are limited to those that have been scientifically demonstrated as effective. Countries should note that these hazard-based control measures are indicative only. The quantifiable outcomes reported for control measures are specific to the conditions of particular studies and would need to be validated under local commercial conditions to provide an estimate of hazard reduction[6]. Government and industry can use choices on hazard-based control measures to inform decisions on critical control points (CCPs) when applying HACCP principles to a particular food process.

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[3] *Guidelines on the Judgement of Equivalence of Sanitary Measures Associated with Food Inspection and Certification Systems* (CAC/GL 53-2003).
[4] *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005)
[5] http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/
[6] FAO/WHO 2009. Risk characterization of microbiological hazards in food. Microbiological risk assessment series 17. Available at http://www.fao.org/docrep/012/i1134e/i1134e00.htm and http://www.who.int/foodsafety/publications/risk-characterization/en/

17. Several hazard-based control measures as presented in these Guidelines are based on the use of physical, chemical and biological decontaminants to reduce the prevalence of *Salmonella* positive carcasses and/or its concentration on positive carcasses. The use of these control measures is subject to approval by the competent authority, where appropriate. Also these Guidelines do not preclude the choice of any other hazard-based control measure that is not included in the examples provided herein, and that may have been scientifically validated as being effective in a commercial setting.

18. Provision of flexibility in application of the Guidelines is an important attribute. They are primarily intended for use by government risk managers and industry in the design and implementation of food safety control systems. The control measures are articulated in this guideline at appropriate steps, however if they could be performed hygienically and effectively they could be applied in other steps in the food chain.

19. The Guidelines should be useful when comparing, or judging equivalence of, different food safety measures for beef and pork meat in different countries.

4. DEFINITIONS

Cattle: Animals of the species of *Bos indicus, Bos taurus,* and *Bubalus bubalis*.

Lairage: Pens, yards and other holding areas used for accommodating animals in order to give them necessary attention (such as water, feed, rest) before they are moved on or used for specific purposes including slaughter.

Nontyphoidal Salmonella: Serovars belonging to the species *Salmonella* enterica excluding the typhoidal serovars of subspecies enterica: serovar Typhi, serovar Paratyphi var. A, B and C, and serovar Sendai[7].

Pigs: Animals of the species *Sus scrofa domesticus*.

5. PRINCIPLES APPLYING TO CONTROL OF *SALMONELLA* IN BEEF AND PORK MEAT

20. Overarching principles for good hygienic practice for meat production are presented in the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005), Section 4: *General Principles of Meat Hygiene*. Two principles that have particularly been taken into account in these Guidelines are:

a. The principles of food safety risk analysis should be incorporated wherever possible and appropriate in the control of *Salmonella* in beef and pork meat from primary production-to-consumption.

b. Wherever possible and practical, competent authorities should formulate risk management metrics[8] so as to objectively express the level of control of *Salmonella* in beef and pork meat that is required to meet public health goals.

6. PRIMARY PRODUCTION-TO-CONSUMPTION APPROACH TO CONTROL MEASURES

7. SPECIFIC CONTROL MEASURES (PRIMARY PRODUCTION)

8. SPECIFIC CONTROL MEASURES (PROCESSING)

9. SPECIFIC CONTROL MEASURES (DISTRIBUTION CHANNELS)

21. Sections 6 through 9 contain beef and pork specific measures. The beef Sections 6 to 9 are found in Annex I and the pork Sections 6 to 9 are found in Annex II.

10. CONTROL MEASURES

22. GHP provides the foundation for most food safety control systems. Where possible and practicable, food safety control systems should incorporate hazard-based control measures and risk assessment. Identification and implementation of risk-based control measures based on risk assessment can be elaborated by application of a risk management framework (RMF) process as advocated in the *Principles and Guidelines for the Conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).

[7] The zoonotic serovars *S*. Java and *S*. Miami share antigenic structure with *S*. Paratyphi B and *S*. Sendai, respectively, and confusion should be avoided.

[8] *Principles and Guidelines for the Conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).

23. While these Guidelines provide generic guidance on development of GHP-based and hazard-based control measures for *Salmonella*, development of risk-based control measures for application at single or multiple steps in the food chain are primarily the domain of competent authorities at the national level. Industry may derive risk-based measures to facilitate application of process control systems.

10.1. Development of risk-based control measures

24. Competent authorities operating at the national level should develop risk-based control measures for *Salmonella* where possible and practical.

25. When risk-modelling tools are developed, the risk manager needs to understand the capability and limitations[9].

26. When developing risk-based control measures, competent authorities may use the quantitative examples of the likely level of control of a hazard in this document.

27. Competent authorities formulating risk management metrics[10] as regulatory control measures should apply a methodology that is scientifically robust and transparent.

11. IMPLEMENTATION OF CONTROL MEASURES

28. Implementation [11] involves giving effect to the selected control measure(s), development of implementation plan, communication on the decision on control measure(s), ensuring a regulatory framework and infrastructure for implementation exists, and a monitoring and evaluation process to assess whether the control measure(s) have been properly implemented.

11.1 Prior to Validation

29. Prior to validation of the hazard-based control measures for *Salmonella*, the following tasks should be completed:

- Identification of the specific measure or measures to be validated. This would include consideration of any measures agreed to by the competent authority and whether any measure has already been validated in a way that is applicable and appropriate to specific commercial use, such that further validation is not necessary.
- Identification of any existing food safety outcome or target, established by the competent authority or industry. Industry may set stricter targets than those set by the competent authority.

11.2 Validation

30. Validation of measures may be carried out by industry and/or the competent authority.

31. Where validation is undertaken for a measure based on hazard control for *Salmonella,* evidence will need to be obtained to show that the measure is capable of controlling *Salmonella* to a specified target or outcome. This may be achieved by use of a single measure or a combination of measures. The *Guidelines for the Validation of Food Safety Control Measures* (CAC/GL 69-2008) (Section VI) provides detailed advice on the validation process.

11.3 Implementation

32. Refer to the Section 9.2 of the *Code of* Hygienic *Practice for Meat* (CAC/RCP 58-2005).

11.3.1 Industry

33. Industry has the primary responsibility for implementing, documenting, applying and supervising process control systems to ensure the safety and suitability of beef and pork meat, and these should incorporate GHP and hazard-based measures for control of *Salmonella* as appropriate to national government requirements and industry's specific circumstances.

34. The documented process control systems should describe the activities applied including any sampling procedures, specified targets (e.g. performance objectives or performance criteria) set for *Salmonella*, industry verification activities, and corrective and preventive actions.

11.3.2 Regulatory systems

35. The competent authority should provide guidelines and other implementation tools to industry as appropriate, for the development of the process control systems.

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[9] *Principles and Guidelines for the Conduct of Microbiological Risk Assessment* (CAC/GL 30-1999).
[10] *Principles and Guidelines for the Conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).
[11] See Section 7 of the *Principles and Guidelines for the Conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).

36. The competent authority may approve the documented process control systems and stipulate verification frequencies. Microbiological testing requirements should be provided for verification of HACCP systems where specific targets for control of *Salmonella* have been stipulated.

37. The competent authority may use a competent body to undertake specific verification activities in relation to the industry's process control systems. Where this occurs, the competent authority should stipulate specific functions to be carried out.

11.4 Verification of control measures

38. Refer to Section 9.2 of the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005) and Section IV of the *Guidelines for the Validation of Food Safety Control Measures* (CAC/GL 69 -2008).

11.4.1 Industry

39. Industry verification should demonstrate that all control measures for *Salmonella* have been implemented as intended. Verification should include observation of monitoring activities, documentary verification, and sampling for *Salmonella* and other microbiological testing as appropriate.

40. Verification frequency should vary according to the operational aspects of process control, the historical performance of the establishment and the results of verification itself.

41. Record keeping is important to facilitate verification and for traceability purposes.

11.4.2 Regulatory systems

42. The competent authority and/or competent body should verify that all regulatory control measures implemented by industry comply with regulatory requirements, as appropriate, for control of *Salmonella*.

12. MONITORING AND REVIEW

43. Monitoring and review of food safety control systems is an essential component of application of a risk management framework (RMF)[12]. It contributes to verification of process control and demonstrating progress towards achievement of public health goals.

44. Information on the level of control of *Salmonella* at appropriate points in the food chain can be used for several purposes, e.g. to validate and/or verify outcomes of food control measures, to monitor compliance with hazard-based and risk-based regulatory goals, and to help prioritize regulatory efforts to reduce foodborne illness. Systematic review of monitoring information allows the competent authority and relevant stakeholders to make decisions in terms of the overall effectiveness of the food safety control systems and make improvements where necessary.

12.1 Monitoring

45. Monitoring should be carried out at appropriate steps throughout the food chain using a validated diagnostic test and randomized or targeted sampling as appropriate[13].

46. For instance the monitoring systems for *Salmonella* and/or indicator organisms, where appropriate, in beef and pork may include testing at the farm and animal level, in the slaughter and processing establishments, and the retail distribution chains.

47. Regulatory monitoring programmes should be designed in consultation with relevant stakeholders, taking into account the most cost-efficient resourcing option for collection and testing of samples. Given the importance of monitoring data for risk management activities, sampling and testing components should be standardized on a national basis and be subject to quality assurance.

48. The type of samples and data collected in monitoring systems should be appropriate for the outcomes sought. Enumeration and sub-typing of microorganisms generally provides more information for risk management purposes than presence or absence testing.

49. Monitoring information should be made available to relevant stakeholders in a timely manner (e.g. to producers, processing industry, consumers).

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[12] See Section 8 of the *Principles and Guidelines for the Conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).

[13] Refer to the relevant Chapters of the OIE Manual and Code on the OIE website: *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* at http://www.oie.int/en/international-standard-setting/terrestrial-manual/access-online/ and the OIE *Terrestrial Animal Health Code* at http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/.

50. Monitoring information from the food chain should be used to affirm achievement of risk management goals. Wherever possible, such information should be combined with human health surveillance data and food source attribution data to validate risk-based control measures and verify progress towards risk-reduction goals. Activities supporting an integrated response include:

- Surveillance of clinical salmonellosis in humans
- Epidemiological investigations including outbreaks and sporadic cases

12.2 Review

51. Periodic review of monitoring data at relevant process steps should be used to inform the effectiveness of risk management decisions and actions, as well as future decisions on the selection of specific control measures, and provide a basis for their validation and verification.

52. Information gained from monitoring in the food chain should be integrated with human health surveillance, food source attribution data, and withdrawal and recall data, where available to evaluate and review the effectiveness of control measures from primary production to consumption.

53. Where monitoring of hazards or risks indicates that regulatory performance goals are not being met, risk management strategies and/or control measures should be reviewed.

12.3 Public health goals

54. Countries should consider the results of monitoring and review when revaluating and updating public health goals for control of *Salmonella* in foods, and when evaluating progress. Monitoring of food chain information in combination with food source attribution data and human health surveillance data are important components[14].

[14] International organizations such as WHO provide guidance for establishing and implementing public health monitoring programmes. WHO Global Foodborne Infections Network (GFN) http://www.who.int/gfn/en/

ANNEX I

SPECIFIC CONTROL MEASURES FOR BEEF
(For Sections 6 to 9)

6. PRIMARY PRODUCTION-TO-CONSUMPTION APPROACH TO CONTROL MEASURES

1. These Guidelines incorporate a "primary production-to-consumption" flow diagram that identifies the main steps in the food chain where control measures for *Salmonella* may potentially be applied in the production of beef. While control in the primary production phase can decrease the number of animals carrying and/or shedding *Salmonella,* controls after primary production are important to prevent the contamination and cross-contamination of carcasses and meat products. The systematic approach to the identification and evaluation of potential control measures allows consideration of the use of controls in the food chain and allows different combinations of control measures to be developed. This is particularly important where differences occur in primary production and processing systems between countries. Risk managers need the flexibility to choose risk management options that are appropriate to their national context.

6.1. Generic flow diagram for application of control measures

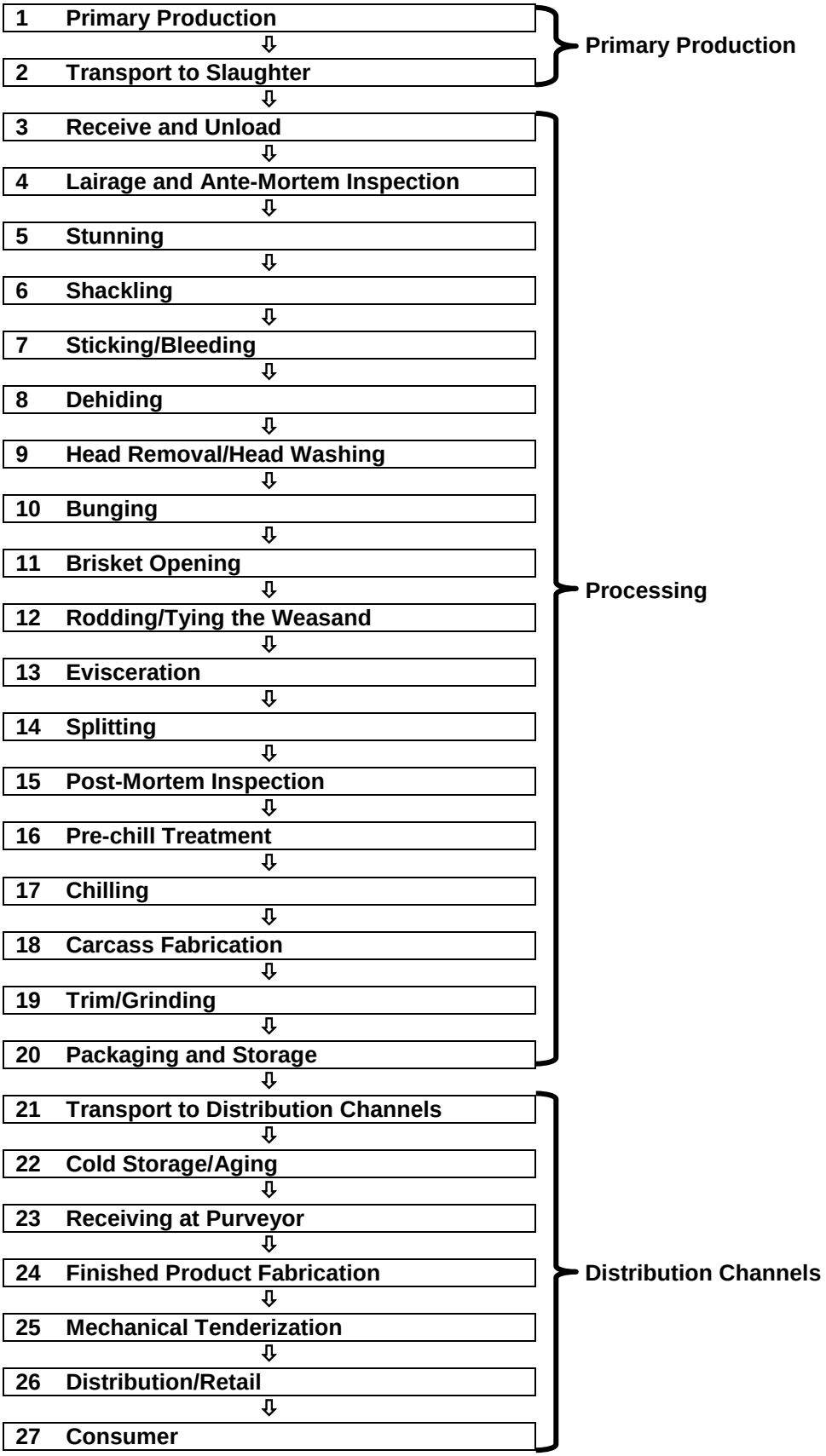
2. A generic flow diagram of the basic beef production processes is presented on the following pages. GHP- or hazard-based interventions that may be applied during processing have been identified at the appropriate process step(s) in the flow diagram.

3. Individual establishments will have variations in process flow and, if possible or required by national law, should develop and adapt HACCP plans accordingly. In countries where HACCP is not widely used, the fundamental principles and practices of HACCP may still be applicable.

4. The basic steps in the slaughter process are to a large extent common but they may be carried out differently in different slaughterhouses or countries. Therefore the necessity to use supplementary mitigation steps will also vary among individual slaughterhouses and countries. The use of supplementary mitigation steps will depend on the food safety targets set, for example, by the competent authorities or customers (e.g. retail chains) and will be influenced by a range of factors, e.g. animal feed, hygienic slaughter procedures, age of livestock, farming practices, size of establishment, equipment, automation, slaughter line speed, and the initial *Salmonella* load from incoming animals (e.g. seasonal variation). A variety of interventions may be used to reduce contamination with *Salmonella* throughout processing. While the effect on *Salmonella* of the individual interventions can be variable, there is clear evidence that use of multiple interventions throughout different production and processing steps as part of a "multiple-hurdle" strategy will provide a more consistent reduction of *Salmonella*.

Process Flow Diagram 1: Primary Production-to-Consumption – Beef

These process steps are generic and the order may be varied as appropriate. This flow diagram is for illustrative purposes only. For application of control measures in a specific country or an establishment, a complete and comprehensive flow diagram should be drawn up.



6.2. Availability of control measures at specific process flow steps addressed in these Guidelines

5. The following table illustrates where specific control measures for *Salmonella* may be applied at each of the process flow steps of the food chain. Control measures are indicated by a check mark and their details are provided in these Guidelines and relevant Chapters of the OIE *Terrestrial Animal Health Code*[15] in the case of GHP. A blank cell means that a specific control measure for *Salmonella* has not been identified for the process flow step.

6. Decontamination treatments may be applied at multiple steps (see following table) within the process flow and may vary among countries, establishments or type of process flow. However, decontamination treatments should not be considered to replace or reduce GHP-based control measures to maintain food safety. Such treatments should not contribute to possible chemical risks.

[15] Refer to the OIE website: http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/

Availability of Control Measures at Specific Steps in the Process Flow

Process Step	GHP-based Control Measures	Hazard-based Control Measures
1 Primary Production ↓	Refer to[15,16]	
2 Transport to Slaughter ↓	Refer to[15,16]	
3 Receive and Unload ↓	✓Refer to[15,16]	
4 Lairage and Ante-Mortem Inspection ↓	✓Refer to[15,16]	
5 Stunning ↓	✓	✓
6 Shackling ↓	✓	✓#
7 Sticking/Bleeding ↓	✓	✓#
8 Dehiding ↓	✓	✓
9 Head Removal/Head Washing ↓	✓	✓*
10 Bunging ↓	✓	
11 Brisket Opening ↓	✓	
12 Rodding/Tying the Weasand ↓	✓	
13 Evisceration ↓	✓	✓*
14 Splitting ↓	✓	✓*
15 Post-Mortem Inspection ↓	✓	
16 Pre-chill Treatment ↓		✓*
17 Chilling ↓	✓	
18 Carcass Fabrication ↓	✓	
19 Trim/Grinding ↓	✓	✓
20 Packaging and Storage ↓	✓	✓
21 Transport to Distribution Channels ↓	✓	
22 Cold Storage/Aging ↓	✓	
23 Receiving at Purveyor ↓	✓	
24 Finished Product Fabrication ↓	✓	
25 Mechanical Tenderization ↓	✓	
26 Distribution/Retail ↓	✓	
27 Consumer	✓	

Details for specific hazard-based controls can be found under Step 5, Stunning
*Details for specific hazard-based controls can be found under Step 8, Dehiding

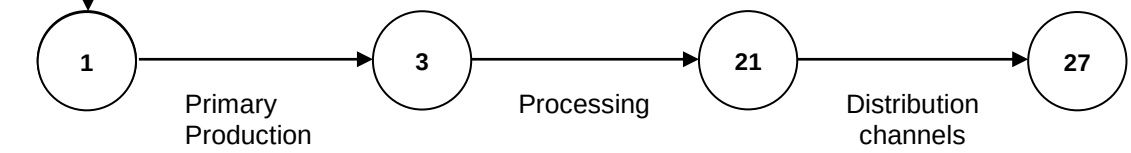
[16] *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

7. CONTROL MEASURES FOR PRIMARY PRODUCTION (STEPS 1 TO 2)

7. These Guidelines should be used in conjunction with, relevant Chapters of the OIE *Terrestrial Animal Health Code*, the *Code of Practice on Good Animal Feeding* (CAC/RCP 54-2004) and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

8. It has been shown in some production systems that control of *Salmonella* in beef can begin on the farm. Practical measures to control *Salmonella* during primary production should be implemented.

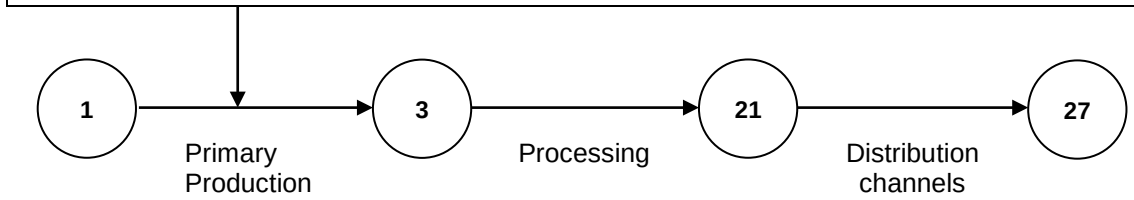
7.1 **Step 1: Primary Production**



7.1.1. GHP-based control measures

9. Refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.

7.2 **Step 2: Transport to Slaughter**



7.2.1 GHP-based control measures

10. Refer to relevant Chapters of the OIE *Terrestrial Animal Health Code* and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

8. CONTROL MEASURES FOR PROCESSING (STEPS 3 TO 20)

11. General control measures including those identified in the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005) should be implemented to prevent the contamination or cross-contamination of carcasses throughout the slaughter process. Control measures that may have particular impact on the control of *Salmonella* include:

a. Equipment and the environment should be kept clean and disinfected as required.

b. Cleaning and disinfection procedures should be employed regularly and performed in a manner to prevent spread of pathogens.

c. Water accumulation on the floor should be avoided and good floor drainage design should be ensured.

d. Equipment should be maintained and designed to avoid contamination and build-up of organic material.

e. Knives should be cleaned and disinfected between carcasses.

f. Personnel should be trained both on operations and food safety aspects of slaughtering. The line speed should leave adequate time to perform all process steps in the operations.

g. Proper employee hygiene practices should be maintained to prevent the creation of unsanitary conditions (e.g. touching product with soiled hands, tools, or garments). Hygiene should include the washing of hands to prevent cross-contamination.

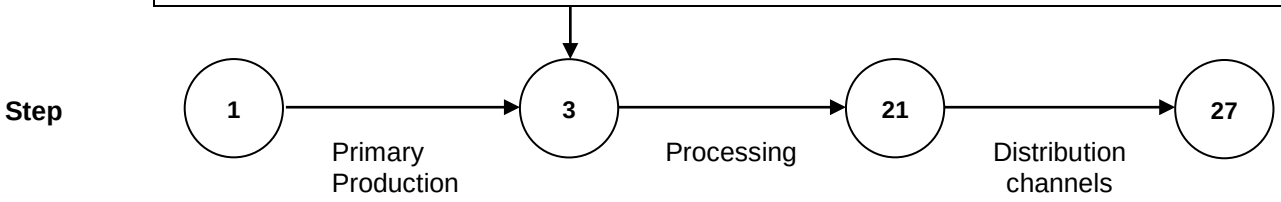
h. Water used for decontamination or cleaning and disinfection of equipment should be potable[17]. In steps prior to stunning clean water may be used.

i. Personnel health.

12. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.

[17] *General Principles of Food Hygiene* (CAC/RCP 1-1969).

8.1 **Step 3: Receive and Unload**



13. This is the point where cattle arrive at the establishment and the ante-mortem process may begin. There is an increased potential for contamination with enteric pathogens such as *Salmonella* during this time because of their presence on the hide and in faeces of cattle. Additionally, transportation to the slaughter facility, handling during transport and unloading, and interaction with other cattle may cause stress and increased shedding of pathogens. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code* and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

8.1.1 GHP-based control measures

14. Loading docks should be maintained clean and should be disinfected as often as practical, taking into account environmental conditions.

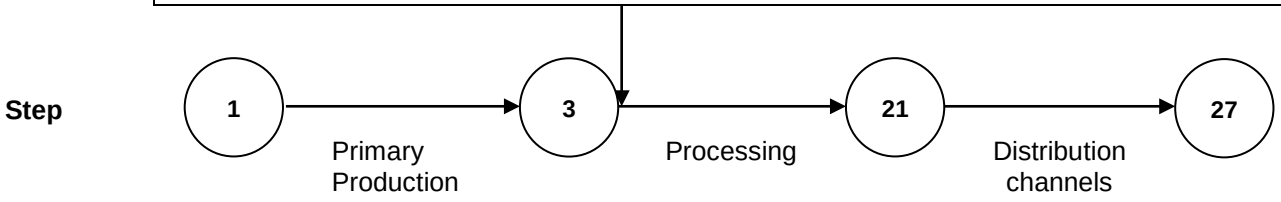
15. When receiving the cattle the slaughterhouse should:

a. Consider any information provided by the farm or feedlot, on the production systems or feedlot controls for *Salmonella*. Effective farm and feedlot management and control can reduce faecal shedding of the organism, as well as reduce the microbial load on the animals, and in the intestinal tract.

b. The availability of food chain information prior to slaughter, e.g. in the form of electronic or paper records would allow food business operators, meat inspectors and risk managers to take steps to minimize cross-contamination during slaughter. Where the *Salmonella* status is known, this information should be communicated to the slaughterhouse before arrival/receiving. Based on this information for the herd, the establishment may choose to segregate and process cattle at the end of the production day. Additional measures such as reduction of the slaughter speed as well as other control measures could be considered. Consider whether other factors that may contribute to the frequency, quantity and location of *Salmonella* in or on cattle, for example the age, type of cattle received (e.g. veal calves), season (i.e. high prevalence season) or geography represent a concern related to pathogen load and therefore whether adjustments to the food safety system need to be made.

c. Establishments should make determinations at receiving/holding about the overall cleanliness of cattle received and classify lots of cattle according to their level of cleanliness. Specific contamination or cross-contamination control measures can be taken based on such determinations. For example, establishments may decide to slow the line speed down to give employees more time to effectively dress the cattle with higher mud scores.

8.2 **Step 4: Lairage and Ante-Mortem Inspection**



16. This is the point where the cattle are held before slaughter. There is an increased potential for contamination with *Salmonella* during this time because of their presence on the hide and in faeces of cattle. Additionally, interaction with other cattle may cause stress and increased shedding of pathogens.

8.2.1 GHP-based control measures

17. Applying a water mist in the holding pens may reduce the accumulation of dust and dirt particles that may carry *Salmonella*.

18. Routinely cleaning the lairage areas, pens and watering points may help reduce cross-contamination. Cleaning of areas when stock is not in the pens and walkways could avoid contamination of cattle through aerosols.

19. Care should be taken to control pest animals (e.g. birds and rodents) in the lairage areas in order to reduce the cross-contamination by these animal vectors.

20. Hide washing measures can be performed on the live animal or on a slaughtered animal before the hide is removed. To prevent the spread of contamination to the environment and subsequently to carcasses (i.e. cross-contamination of carcasses) the following strategies may be employed:

a. Identify or segregate animals with excessive visible contamination.

b. Limit the overspray of water.

c. Remove excess water from the hide after the wash to decrease cross-contamination during dehiding.

d. Avoid pooling of water around the anus of the carcass prior to dropping the bung.

21. Bacteriophage treatment may be applied to appropriately clean cattle and allowing the bacteriophage appropriate contact time can reduce the bacterial load present on the animal prior to slaughter.

22. Time spent at lairage and stocking density should be kept to a minimum.

23. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.

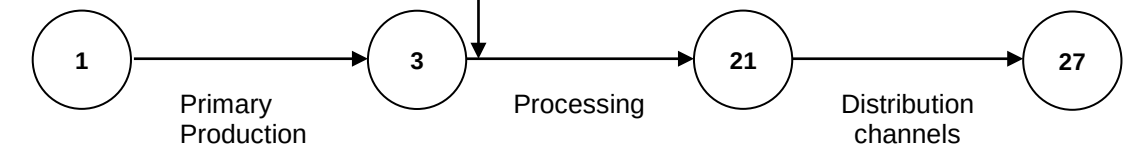
8.2.2 Ante-mortem Inspection

24. Ante-mortem inspection should be carried out as soon as practicable after delivery of animals to the lairage. Segregation procedures may be needed for animals designated as potentially infected at the farm level or for animals identified as suspected cases of salmonellosis to minimize contamination.

25. Ante-mortem inspection may serve as a control step for identifying excessive soiling of the hide with faeces - a risk factor for subsequent cross-contamination from the hide to the carcasses.

26. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.

8.3 **Step 5: Stunning**



27. This is the point where the animal is rendered unconscious. This can result in a shedding reflex and become a cross-contamination point due to animal contact with the ground after stunning.

8.3.1 GHP-based control measures

28. Keep skids outside and inside the stunning box clean.

29. In case of shedding reflex, faeces should be removed in a sanitary manner.

8.3.2 Hazard-based control measures

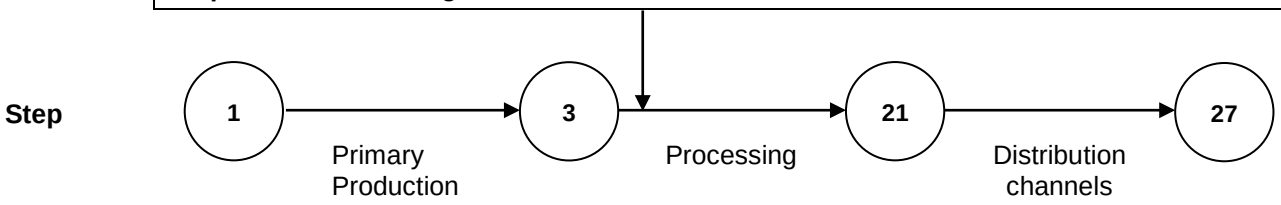
30. Decontamination treatments have been shown to be effective in the reduction of pathogens including *Salmonella* on cattle hides. Examples of decontamination treatments are listed below. These hide-on treatments can be used after stunning or at subsequent steps until dehiding. Care should be taken to minimize cross-contamination especially after the hide has been opened at any time.

31. Washes containing various organic acids, such as lactic acid and acetic acid, may be effective to reduce *Salmonella*. A commercial study found the prevalence of *Salmonella* was reduced following the application of a lactic acid wash(s), for example from 74% to 50% (95% confidence interval 30 - 70)[18].

32. Washes containing other chemicals, such as peroxyacetic acid and acidified sodium chlorite, may be effective to reduce *Salmonella*. Commercial studies found the prevalence of *Salmonella* was reduced following the application of hydrogen bromide, chlorine, or sodium hydroxide, for example from 62% to 26% (range 18 - 36%).

[18] For all numerical values in hazard-based measures, refer to Interventions for the Control of Nontyphoidal *Salmonella* spp. In Beef and Pork. Report of the Joint FAO/WHO Expert Meeting, 2015.

8.4 **Step 6: Shackling**



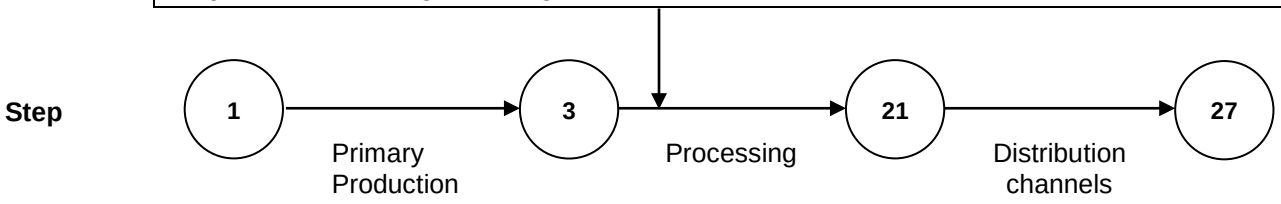
33. This is the area where the carcass is attached to a device to suspend it to facilitate bleeding and/or dressing.

8.4.1 GHP-based control measures

34. Animals should be shackled, hung or placed in the bleeding area in such a way that contact between stick wounds and external surfaces of this or other animals (e.g. hide/hooves) is avoided.

35. Electrical stimulation can be used to hasten the attainment of rigor-mortis and reduction of pH.

8.5 **Step 7: Sticking/Bleeding**



36. This is the point in the process where the animal is bled. Regardless of the slaughter method, it is important for the establishment to minimize contamination of the carcass during any cut made at this step.

8.5.1 GHP-based control measures

37. Measures to prevent contamination of the carcass underlying the hide during the initial cut can include:

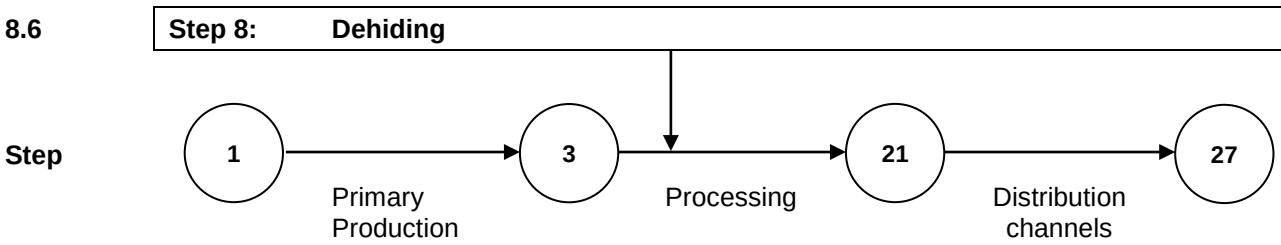
a. Using the smallest effective cut possible to accomplish bleeding.

b. Using a validated one- or two-knife system including hand and knife cleaning and knife disinfecting between sticking each carcass as necessary.

c. It may be necessary to clean the carcass area prior to sticking. A mechanical process like scraping the hide surface to remove physical contamination can be utilized.

d. Be aware of mud-contamination moving downwards into the cut.

8.6 **Step 8: Dehiding**



38. This is the point in the process where the hide is removed from the animal. Hides are a significant source of potential contamination with *Salmonella*. It is important to maintain sanitary conditions when handling the hide.

8.6.1 GHP-based control measures

39. Hide-removal measures to prevent direct contamination of the carcass during the opening of the hide (other than sticking) can include:

a. Removing visible contamination at the intended cut line (e.g. with air knives, by using dedaggers or by steam vacuuming).

b. Using a two-knife system whereby one knife is used for opening the hide and another disinfected knife is used for dehiding by leading the knife between skin and meat surface.

c. Removing the udder in such a way that the surface and the contents do not contaminate the carcass.

d. Following procedures to prevent contamination of the exposed carcass from the hide, a soiled knife or other utensils or employee hand, for example.

40. Measures to limit cross-contamination of carcasses during hide removal can include:

a. Employing shields/barriers (e.g. papers) to prevent contamination and cross-contamination of carcasses.

b. Severing or removing the switch on the tail when using hide pullers to minimize the possibility that contaminants become airborne from splattering or flapping of the hide.

c. When employing a mechanical hide puller:

i. ensure mechanical hide pullers pull the hide away from the carcass in a downward or backwards motion (i.e. not upward), thereby reducing the potential for contamination to drip, splatter, or flap onto the carcass or employees handling de-hided carcasses.

ii. ensure the exterior side of the hide does not touch, slap, or flap onto the carcass when being removed.

d. Maintain equipment contacting the de-hided carcass clean including the mechanical hide puller contact points with the hide, hands and garments of the employees handling the hide and the carcass, knives, etc.

e. Ensuring adequate distance between carcasses throughout the slaughter dressing process to minimize carcass-to-carcass contact and cross-contamination.

41. Line speed and other process parameters should be monitored and adjusted during instances of excessive hide contamination to ensure proper removal of the hide.

42. Contamination detection techniques, for example, chlorophyll detection equipment, may be used, at this point or later in the dressing process, as a means to identify faecal material on carcasses.

8.6.2 Hazard-based control measures

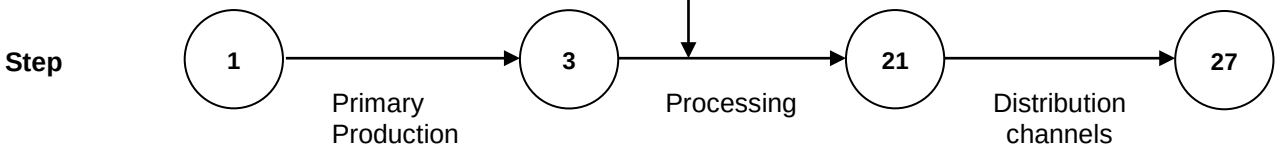
43. Decontamination treatments after the hide has been removed have been shown to be effective in the reduction of pathogens including *Salmonella* on carcasses. Examples of decontamination treatments are listed below. These hide-off decontamination treatments can be used immediately after hide removal and at subsequent steps. Equipment for decontamination treatment should be monitored to ensure that the treatment is performed according to the validation parameters.

44. Thermal treatments (water and steam) in an appropriate combination of temperature and time, have been shown to reduce *Salmonella* prevalence. It is generally accepted that the carcass surface temperature should reach at least 70°C. A commercial study found thermal treatments (hot water at 74-88°C at the pipe for 18-39 seconds) reduced the prevalence of *Salmonella* from 30 to 2%. Reductions between 1 and 2 $\log_{10}$ CFU/cm^2 could be expected under commercial setting.

45. Organic acid washes, such as lactic acid and acetic acid at an appropriate temperature, have been shown to reduce *Salmonella* concentration. Challenge studies under laboratory and pilot establishment conditions found organic acid washes reduced *Salmonella* levels from almost no reduction up to 3 $\log_{10}$ CFU/cm^2 compared to water. Reductions exceeding 1 $\log_{10}$ CFU/cm^2 would not be expected under commercial settings.

46. Other chemical washes, such as peroxyacetic acid and acidified sodium chlorite, have been shown to reduce *Salmonella* concentration. Challenge studies under laboratory and pilot establishment conditions found other chemical washes reduced *Salmonella* levels between almost no reduction to 2.6 $\log_{10}$ CFU/cm^2 compared to water. Reductions exceeding 1 $\log_{10}$ CFU/cm^2 would not be expected under commercial settings.

8.7 **Step 9: Head Removal/Head Washing**



47. This is the point in the slaughter process where the head is totally or partially removed from the carcass. It is important to maintain hygienic conditions because cross-contamination can occur if the head comes into contact with other carcasses or heads, equipment and employees.

8.7.1 GHP-based control measures

48. Measures to minimize contamination of heads, equipment, and employees can include:

a. Removing heads in a manner that avoids contamination with digestive tract contents.

b. Tying the oesophagus (weasand) as soon as possible after stunning to minimize contamination of buccal cavity and head with ingesta.

c. If necessary, adequately washing heads, including thoroughly flushing the nasal cavities and mouth, before washing the outside surfaces.

d. Limiting the splashing of water when washing heads in order to prevent cross-contamination and to limit airborne contaminants.

e. Properly maintaining, cleaning and disinfecting knives as needed.

f. Ensuring that:

i. excessively contaminated heads do not enter the cabinet,

ii. the equipment holding the head does not contaminate the head,

iii. spray from the cabinet does not spread contamination to adjacent heads if a head wash cabinet is used at this point in the slaughter process, or

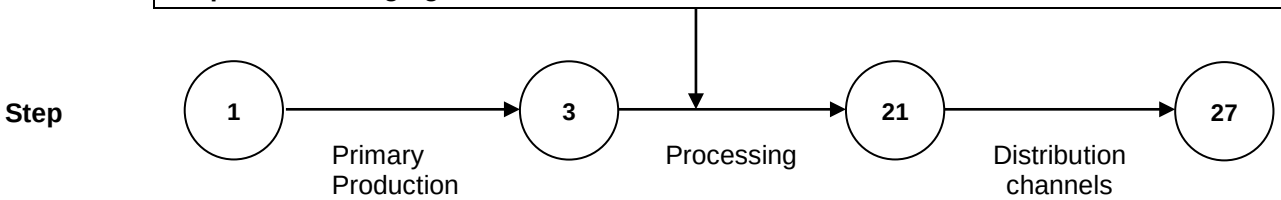
iv. if a wash is being used, it does not contaminate the cheek meat and tongue of the head being washed and inspected.

g. Horns should be removed with surrounding hides to minimize contamination.

h. De-hided heads should be kept in a manner to minimize contamination with other hides, floors or inner walls.

49. After dehiding and removal of the head and before passing the carcass on to brisket/midline opening, any visible faecal contamination and residual hairs should be removed. This can be done by knife trimming where visible contamination is cut off and discarded. Knives should be cleaned and disinfected regularly, at least between each carcass trimmed, and hands should also be washed between carcasses as necessary.

8.8 **Step 10: Bunging**



50. This is the point in the slaughter process where a cut is made around the rectum (i.e. terminal portion of the large intestine) to free it from the carcass, and then it is tied off to prevent spillage of faecal material.

8.8.1 GHP-based control measures

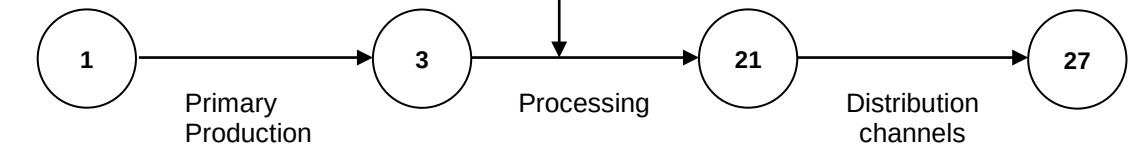
51. Measures to prevent carcass contamination during bunging can include:

a. Completing bunging operations prior to hide removal.

b. Putting plastic bags and ties on the bung in a sanitary manner.

52. Clean and disinfect equipment between carcasses, for example by using organic acids or heat, where applicable.

8.9 **Step 11: Brisket Opening**



53. This is the point in the process where the brisket is split (i.e. cut along the centreline).

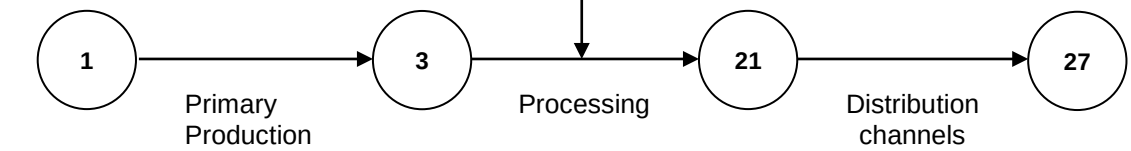
8.9.1 GHP-based control measures

54. Measures to prevent the introduction of contamination into the carcass during brisket opening can include:

a. Cleaning and disinfecting the brisket saw and knife between each carcass and ensuring that the gastrointestinal tract is not punctured.

b. If the gastrointestinal tract has been punctured causing a major contamination, the carcass should be identified and additional procedures to avoid cross-contamination should be performed.

8.10 **Step 12: Rodding/Tying the Weasand**



55. This is the point in the process where the establishment uses a metal rod to free the oesophagus (weasand) from the trachea and surrounding tissues. Weasand meat may be recovered from the gastrointestinal tract for use in raw ground beef production. It is important, at this point in the process, that contamination is not transferred from the exterior of the carcass to the interior or onto the weasand. In addition, if, during the rodding process, the gastro-intestinal tract is punctured, it can cause contamination of the carcass interior and exterior with ingesta content.

8.10.1 GHP-based control measures

56. The weasand should be closed (i.e. tied) to prevent rumen spillage.

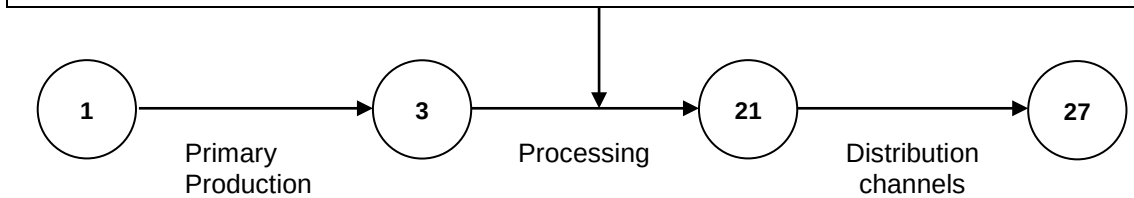
57. Measures to prevent cross-contamination of the carcass during rodding the weasand can include:

a. Changing or disinfecting the weasand rod between each carcass.

b. Cleaning the weasand to minimize cross-contamination, and chilling it quickly to prevent the growth of *Salmonella*.

c. If the gastrointestinal tract has been punctured causing a major contamination, the carcass should be identified and additional procedures to avoid cross-contamination should be performed.

8.11 **Step 13: Evisceration**



58. This is the point in the process where the removal of the viscera (e.g. the edible offal that includes the heart, intestines, rumen, liver, spleen, and kidneys when presented with viscera) occurs. If the viscera are not handled properly, or if employee hygiene practices are not being followed, contamination of the carcass and edible offal can occur.

8.11.1 GHP-based control measures

59. Measures to prevent contamination of the viscera during removal can include:

a. Removing visible contamination from the area to be cut (e.g. by trimming, by using air knives, or by steam vacuuming) before the cut is made. This should be done in a timely manner and in accordance with commonly accepted reconditioning procedures.

b. If pregnant, removing the uterus in a manner that prevents contamination of the carcass and viscera.

c. Cutting through tonsils should be avoided because of the risk of spreading *Salmonella* from tonsil tissue.

60. Measures to ensure that employees do not contaminate carcasses during evisceration can include:

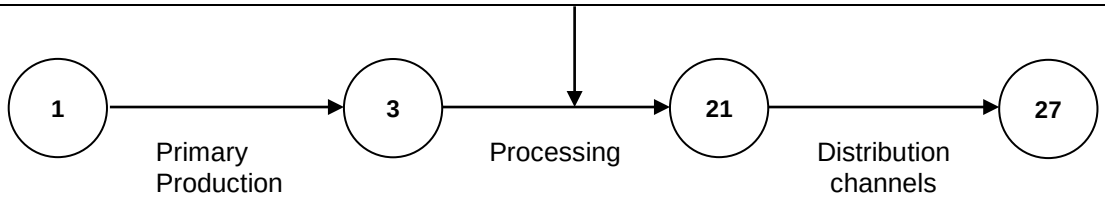
a. Properly using knives to prevent damage (i.e. puncturing) to the rumen and intestines.

b. Using footbaths or separate footwear by employees on moving evisceration lines to prevent contaminating other parts of the operation.

c. Trained and experienced individuals should perform the evisceration; this is particularly important at higher line speeds.

d. If the gastrointestinal tract has been punctured causing a major contamination no further work should be carried out on the carcass until it has been removed from the slaughter line.

8.12 **Step 14: Splitting**



61. This is the point in the process where carcasses are split vertically into two halves.

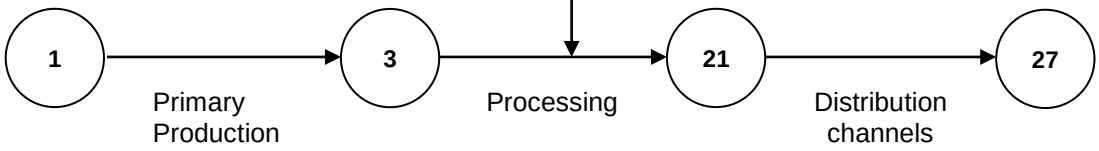
8.12.1 GHP-based control measures

62. Measures to prevent the split carcass from becoming contaminated can include:

a. Cleaning to remove organic material and disinfecting the saws and knives between each carcass.

b. Allowing adequate distance between carcasses (i.e. avoid carcass-to-carcass contact) and walls and equipment.

8.13 **Step 15: Post-Mortem Inspection**



63. This is the point in the process where detailed inspection of carcasses is carried out.

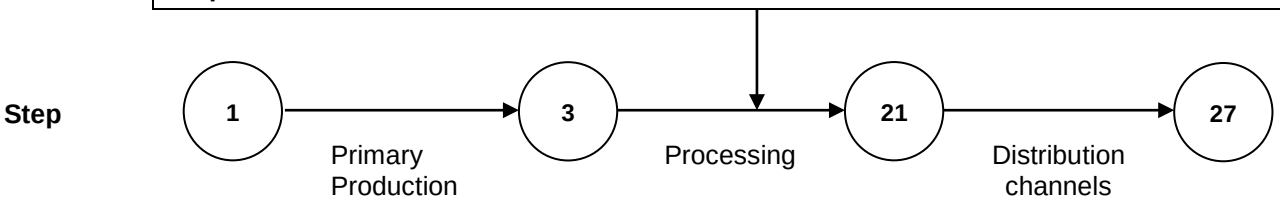
8.13.1 GHP-based control measures

64. Line speeds and the amount of light should be appropriate for effective post-mortem inspection of carcasses.

65. The procedures should be planned to avoid cross-contamination. Touching the carcasses with hands, tools or garments may cause cross-contamination.

66. The need for routine palpations and incisions during post-mortem inspection should be weighed against the potential impact on cross-contamination with *Salmonella* through the application of these techniques.

8.14 **Step 16: Pre-chill Treatment**

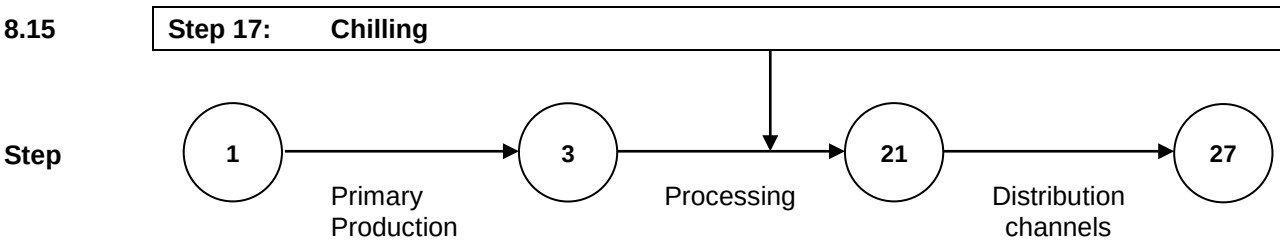


67. At this stage in the process, the carcass may be subject to a treatment in order to remove *Salmonella* and other contaminants from the surface of the carcass prior to entering the chilling room. The treatment may be also applied at other suitable stages.

8.14.1 Hazard-based control measures

68. Hazard-based control measures identified in step 8, Dehiding, can be used at this stage in the slaughter process to reduce *Salmonella*.

8.15 **Step 17: Chilling**



69. This is the point in the process where the carcass is chilled.

8.15.1 GHP-based control measures

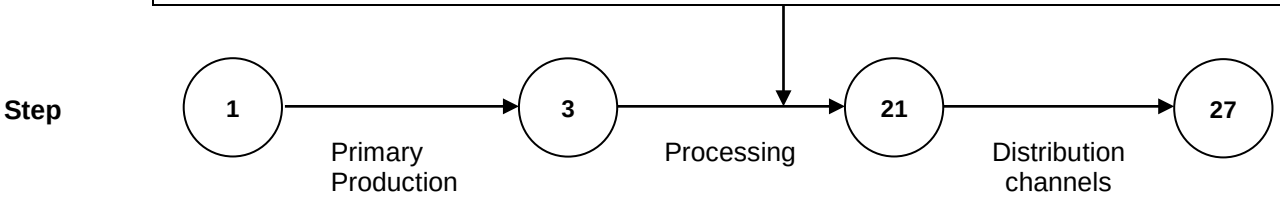
70. Chilling inhibits the growth of *Salmonella*. The effect of chilling depends on carcass spacing, air flow, and cooling capacity. Carcasses should be adequately spaced to allow for effective cooling and prevention of cross-contamination.

71. Carcass chilling should begin within one hour of bleed-out.

72. Effective temperature control should be implemented to achieve and maintain a carcass surface temperature to prevent the growth of *Salmonella*.

73. Sanitary conditions should be maintained in the chilling room.

8.16 **Step 18: Carcass Fabrication**



74. These steps include cutting and deboning that can result in wholesale pieces.

8.16.1 GHP-based control measures

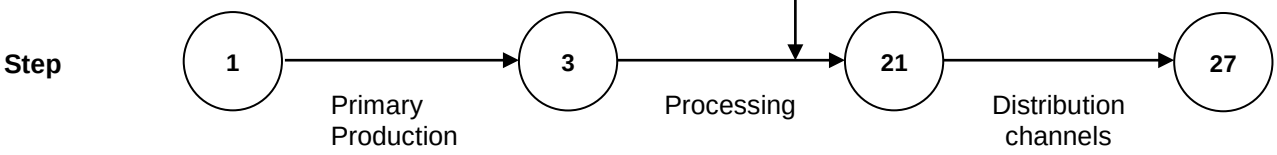
75. Boning and fabrication rooms should be kept at a temperature that limits the ability for *Salmonella* to grow.

76. In order to reduce time out of chilling room, and to limit the growth of *Salmonella*, a reasonable flow of products should be ensured.

77. Knives, saws, slicers, and other food contact surfaces should be cleaned and disinfected as frequently as necessary to prevent the creation of unsanitary conditions.

78. Airflow should be controlled to prevent cross-contamination from slaughter operations, e.g. positive air pressure in carcass fabrication area relative to other areas in the slaughter operations.

8.17 **Step 19: Trim/Grinding**



79. This is the point where during carcass fabrication, trim may be generated and used for the production of ground beef.

8.17.1 GHP-based control measures

80. Products should be stored at temperatures to prevent the growth of *Salmonella*.

81. Equipment used for this operation should be adequately maintained and adjusted.

82. In order to avoid cross-contamination, equipment and environment should be cleaned on a regular basis and good personal hygiene practices should be followed by employees.

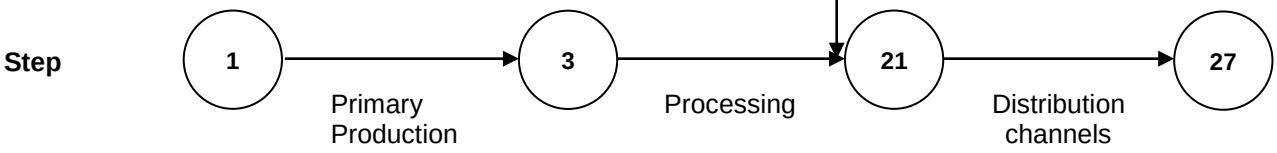
83. Processes such as grinding, may potentially spread contamination in the meat. There should be increased awareness when handling of the meat throughout the rest of the food chain.

84. If equipment is used to process meat of a different risk profile (e.g. adult beef vs. veal) the equipment should be cleaned when changing from higher risk product to lower risk products. Alternatively lower risk product should be processed first.

8.17.2 Hazard-based control measures

85. Chemical washes, such as lactic acid and peroxyacetic acid, have been shown to reduce *Salmonella* concentration. Challenge studies under laboratory and pilot establishment conditions found other chemical washes reduced *Salmonella* levels between almost no reduction to 4 $\log_{10}$ CFU/g compared to water. Reductions exceeding 1 $\log_{10}$ CFU/g would not be expected under commercial setting.

8.18 **Step 20: Packaging and Storage**



8.18.1 GHP-based control measures

86. Packaging rooms should be kept at a temperature that limits the growth of *Salmonella*.

87. Use of various technology packaging may limit the growth of *Salmonella.*

88. The storage room should be maintained at a temperature that prevents the growth of *Salmonella*.

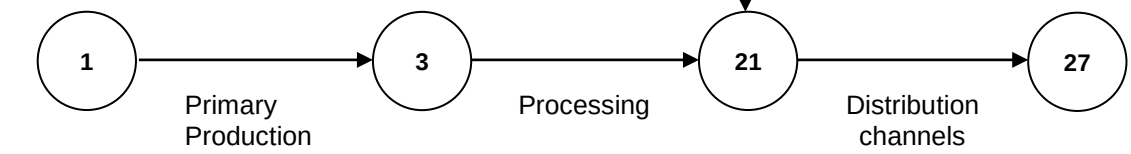
89. The temperature of the packaging and storage rooms and meat should be monitored and documented.

8.18.2. Hazard-based control measures

90. Various doses of ionizing radiation have been shown to be effective at eliminating *Salmonella* in warm, chilled or frozen beef. Application and control of the process should take into consideration the *General Standard for Irradiated Foods* (CODEX-STAN 106-1983) and the *Code of Practice for Radiation Processing of Foods* (CAC/RCP 19-1979). Irradiation of ground beef resulted in D_{10} values (kGy) of 0.618-0.661 for *Salmonella*, with differences possible between serovars.

9. CONTROL MEASURES FOR DISTRIBUTION CHANNELS (STEPS 21 TO 27)

9.1 **Step 21: Transport to Distribution Channels**



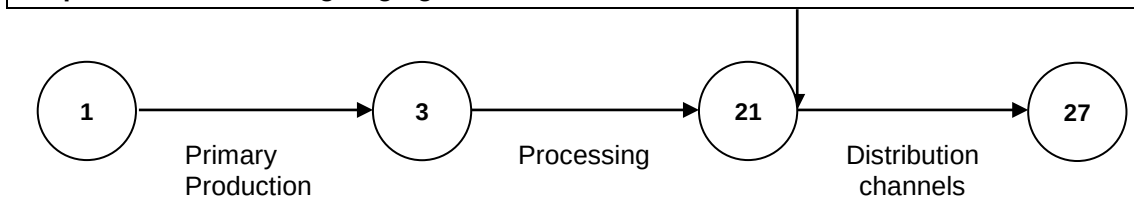
9.1.1 GHP-based control measures

91. Transportation vehicles should be kept clean and free of pests.

92. Transportation vehicle should be maintained at a temperature that ensures the temperature of the chilled meat is adequate to prevent the growth of *Salmonella*.

93. Temperature of vehicle and meat should be monitored and documented. Meat should be chilled before loading onto the vehicle for transport.

9.2 **Step 22: Cold Storage/Aging**



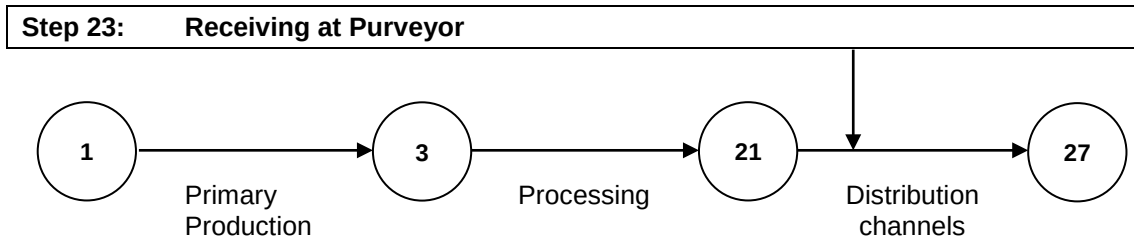
9.2.1 GHP-based control measures

94. Storage room temperature should be maintained at a temperature that prevents the growth of *Salmonella* in the chilled meat.

95. Storage room temperature should be monitored and documented.

96. During dry-aging, the humidity should be kept low to prevent the growth of *Salmonella*.

9.3 **Step 23: Receiving at Purveyor**



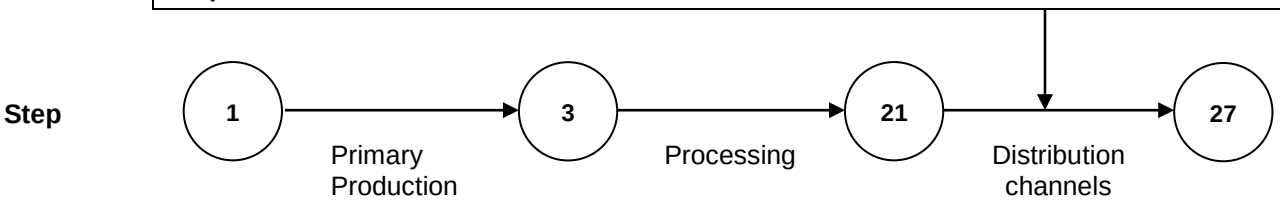
9.3.1 GHP-based control measures

97. The state of products shipped, the containers, their content and the temperature of the product should be verified.

98. An agreement between the abattoir and the purveyors for sharing microbiological testing results of the material received may need to be established. The agreement could include whether presumptive or confirmed results are required and the actions that will be taken in the event of a positive result.

99. Products should be kept at a temperature to prevent the growth of *Salmonella*.

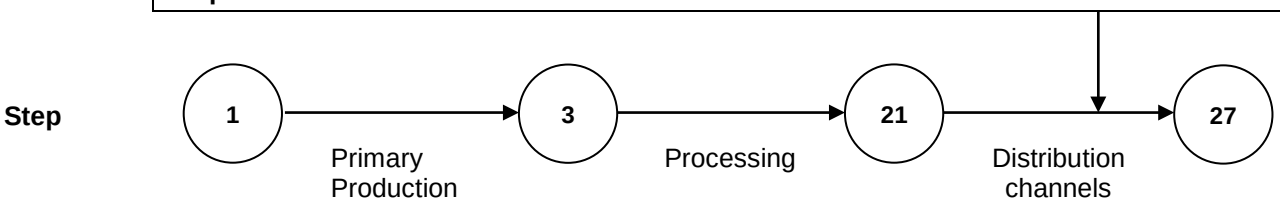
9.4 Step 24: Finished Product Fabrication



9.4.1 GHP-based control measures

100. Products should be stored at temperatures to prevent the growth of *Salmonella*.

9.5 Step 25: Mechanical Tenderization



101. This is the point in the process where the meat is subjected to the process of breaking fibres mechanically or manually. This step can be a cross-contamination point if the procedures and handling are not performed in a sanitary manner and by trained and experienced employees.

9.5.1 GHP-based control measures

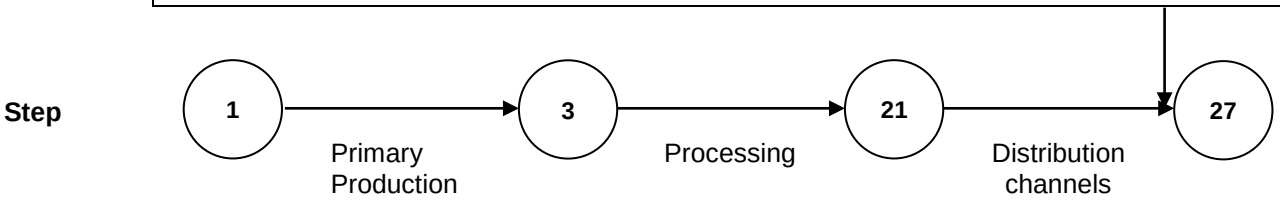
102. Products should be stored at temperatures to prevent the growth of *Salmonella.*

103. Equipment used for this operation should be adequately maintained and adjusted.

104. In order to avoid cross-contamination, equipment and environment should be cleaned on a regular basis and good personal hygiene practices should be followed by employees.

105. Processes such as mechanical tenderization may potentially increase contamination in the meat. There should be increased awareness when handling of the meat throughout the rest of the food chain.

9.6 Step 26: Distribution/Retail



9.6.1 GHP-based control measures

106. Fresh meat should be held at a temperature that prevents the growth of *Salmonella*.

107. The temperature of the storage room and display cases should be monitored and documented.

108. Cross-contamination from or to other food items should be prevented.

109. Food business operators serving meat for direct consumption to consumers (e.g. caterers, restaurateurs) should take appropriate measures to:

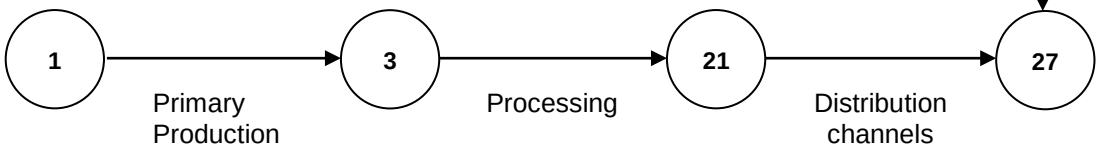
a. Prevent cross-contamination.

b. Maintain appropriate storage temperature.

c. Ensure proper cleaning.

d. Ensure proper cooking.

9.7 **Step 27: Consumer**



9.7.1 GHP-based control measures

110. Consumers should be informed about the potential risk associated with finished beef product in order to follow instructions and make informed choices on how to avoid the spread and growth of *Salmonella* (e.g. storage, thawing and cooking temperatures, hygiene including hand washing). The WHO Five Keys to Safer Food[19] assists in this process.

111. Cooking of beef can reduce or eliminate *Salmonella*.

112. Consumers should be appropriately informed of raw treated meat (e.g. mechanically tenderized, minced meat) so they can take appropriate actions to make sure meat is properly cooked.

113. Special attention should be paid to the education of all persons preparing food, and particularly to those preparing food for the young, old, pregnant and immuno-compromised.

114. Consumers should wash and disinfect food contact surfaces and utensils after raw beef preparation to significantly reduce the potential for cross-contamination in the kitchen.

115. The above information to consumers should be provided by the competent authority, local government, health agencies, manufacturers, retailers or other consumer sources and through multiple channels such as national media, health care professionals, food hygiene trainers, product labels, pamphlets, school curricula and cooking demonstrations.

[19] http://www.who.int/foodsafety/consumer/5keys/en/

Annex II

SPECIFIC CONTROL MEASURES FOR PORK

(For Sections 6 to 9)

6. PRIMARY PRODUCTION-TO-CONSUMPTION APPROACH TO CONTROL MEASURES

1. These Guidelines incorporate a “primary production-to-consumption” flow diagram that identifies the main steps in the food chain where control measures for *Salmonella* may potentially be applied in the production of pork. While control in the primary production phase can decrease the number of animals carrying and/or shedding *Salmonella,* controls after primary production are important to prevent the contamination and cross-contamination of carcasses and meat products. The systematic approach to the identification and evaluation of potential control measures allows consideration of the use of controls in the food chain and allows different combinations of control measures to be developed. This is particularly important where differences occur in primary production and processing systems between countries. Risk managers need the flexibility to choose risk management options that are appropriate to their national context.

6.1. Generic flow diagram for application of control measures

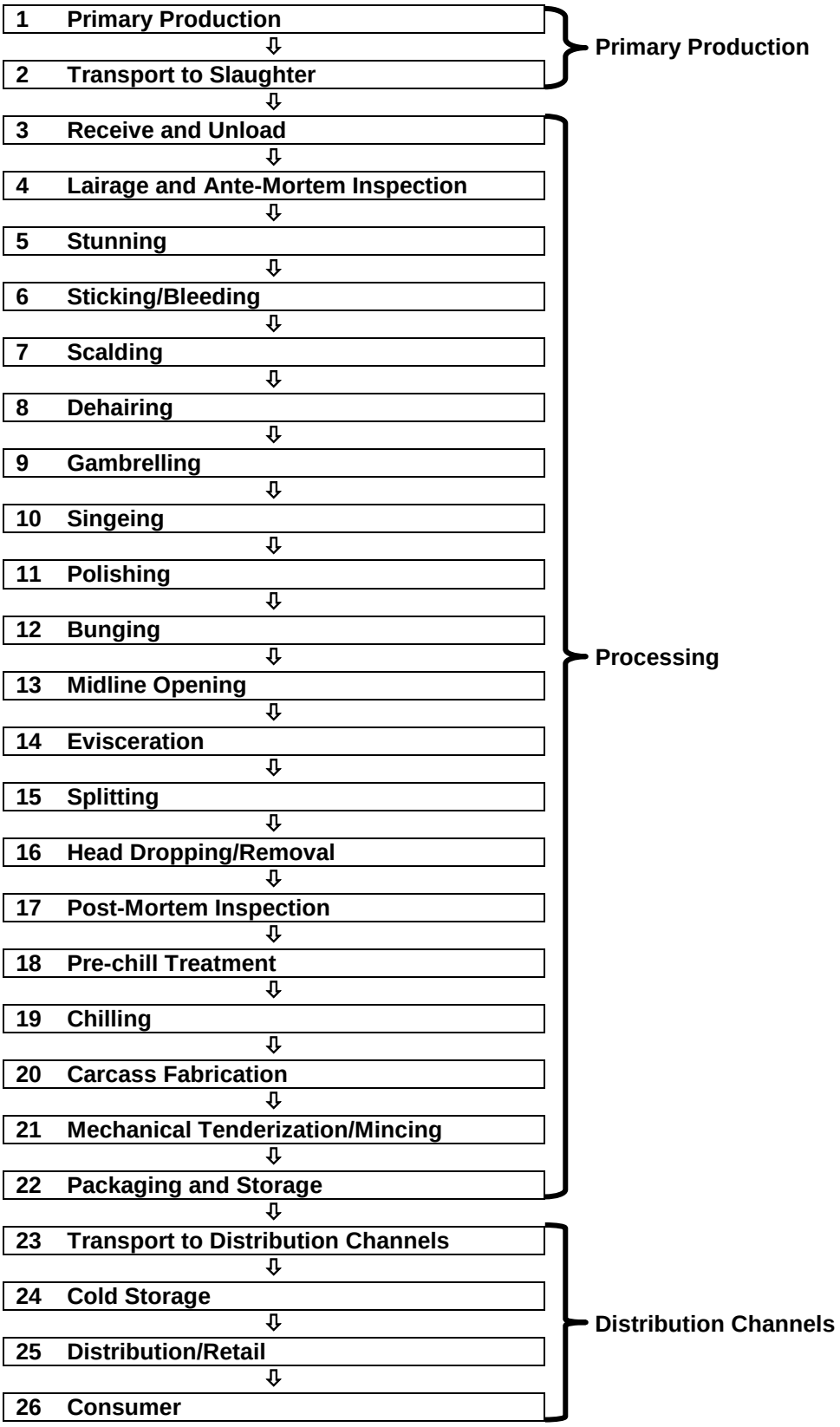
2. A generic flow diagram of the basic pork production processes is presented on the following pages. GHP- or hazard-based interventions that may be applied during processing skin-on carcasses have been identified at the appropriate process step(s) in the flow diagram.

3. Individual establishments will have variations in process flow and, if possible or required by national law, should develop and adapt HACCP plans accordingly. In countries where HACCP is not widely used, the fundamental principles and practices of HACCP may still be applicable.

4. The basic steps in the slaughter process are to a large extent common for processing pigs skin-on, but they may be carried out differently in different slaughterhouses or countries. Therefore the necessity to use supplementary mitigation steps will also vary among individual slaughterhouses and countries. The use of supplementary mitigation steps will depend on the food safety targets set, for example, by the competent authorities or customers (e.g. retail chains) and will be influenced by a range of factors, for example animal feed, hygienic slaughter procedures, age of livestock, farming practices, size of establishment, equipment, automation, slaughter line speed, and the initial *Salmonella* load from incoming animals (e.g. seasonal variation). A variety of interventions may be used to reduce contamination with *Salmonella* throughout processing. While the effect on *Salmonella* of the individual interventions can be variable, there is clear evidence that use of multiple interventions throughout different production and processing steps as part of a “multiple-hurdle” strategy will provide a more consistent reduction of *Salmonella*.

Process Flow Diagram: Primary Production–to-Consumption – Pork

These process steps are generic and the order may be varied as appropriate. This flow diagram is for illustrative purposes only. For application of control measures in a specific country or an establishment, a complete and comprehensive flow diagram should be drawn up.



6.2. Availability of *Salmonella* control measures at specific process flow steps addressed in these Guidelines

5. The following table illustrates where specific control measures for *Salmonella* may be applied at each of the process flow steps of the food chain. Control measures are indicated by a check mark and their details are provided in these Guidelines and relevant Chapters of the OIE *Terrestrial Animal Health Code*[20] in the case of GHP. A blank cell means that a specific control measure for *Salmonella* has not been identified for the process flow step.

6. Decontamination treatments may be applied at multiple steps (see following table) within the process flow and may vary among countries, establishments or type of process flow. However, decontamination treatments should not be considered to replace or reduce GHP-based control measures to maintain food safety. Such treatments should not contribute to possible chemical risks.

[20] Refer to the OIE website: http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/

Availability of Control Measures at Specific Steps in the Process Flow

Process Step	GHP-based Control Measures	Hazard-based Control Measures
1 Primary Production ↓	Refer to[20,21]	
2 Transport to Slaughter ↓	Refer to [20,21]	
3 Receive and Unload ↓	✓ Refer to [20,21]	
4 Lairage and Ante-Mortem Inspection ↓	✓ Refer to [20,21]	
5 Stunning ↓	✓	
6 Sticking/Bleeding ↓	✓	
7 Scalding ↓	✓	✓
8 Dehairing ↓	✓	
9 Gambrelling ↓	✓	
10 Singeing ↓	✓	✓
11 Polishing ↓	✓	
12 Bunging ↓	✓	
13 Midline Brisket Opening ↓	✓	
14 Evisceration ↓	✓	
15 Splitting ↓	✓	
16 Head Dropping/Removal ↓	✓	✓#
17 Post-Mortem Inspection ↓	✓	
18 Pre-chill Treatment ↓	✓	✓
19 Chilling ↓	✓	
20 Carcass Fabrication ↓	✓	
21 Mechanical Tenderization/Mincing ↓	✓	
22 Packaging and Storage ↓	✓	✓
23 Transport to Distribution Channels ↓	✓	
24 Cold Storage ↓	✓	
25 Distribution/Retail ↓	✓	
26 Consumer	✓	

Details for specific hazard-based controls can be found under Step 18, Pre-chill Treatment

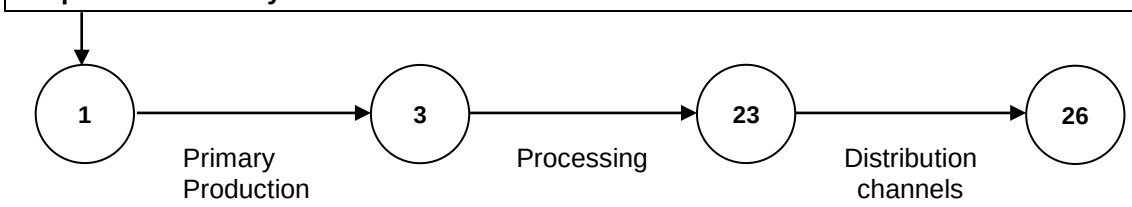
[21] *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

7. CONTROL MEASURES FOR STEP 1 TO 2 (PRIMARY PRODUCTION)

7. These Guidelines should be used in conjunction with relevant Chapters of the OIE *Terrestrial Animal Health Code*, the *Code of Practice on Good Animal Feeding* (CAC/RCP 54-2004), and *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

8. It has been shown in some production systems that control of *Salmonella* in pork can begin on the farm. *Salmonella* prevalence in the herd is a factor for determining the *Salmonella* prevalence and numbers on carcasses. Practical measures to control *Salmonella* during primary production should be implemented.

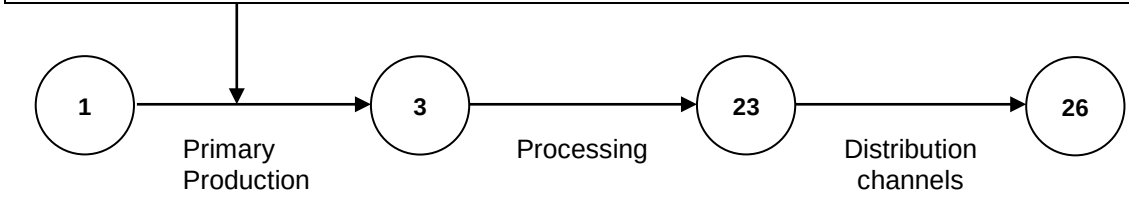
7.1 **Step 1: Primary Production**



7.1.1 GHP-based control measures

9. Refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.

7.2 **Step 2: Transport to Slaughter**



7.2.1 GHP-based control measures

10. Refer to relevant Chapters of the OIE *Terrestrial Animal Health Code* and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

8. CONTROL MEASURES FOR STEPS 3 TO 22 (PROCESSING)

11. An increased diversity of S. *enterica* serovars has been observed after slaughter compared to that of isolates from pen mates on the farm. The larger diversity suggests that pigs may be exposed to other serovars after leaving the farm i.e. during transport, in lairage and at slaughter. Therefore there should be focus on cross-contamination during these steps.

12. General control measures including those identified in the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005) should be implemented to prevent the contamination or cross-contamination of carcasses throughout the slaughter process. Control measures that may have particular impact on the control of *Salmonella* include:

a. Equipment and the environment should be kept clean and disinfected as required.

b. Cleaning and disinfection procedures should be employed regularly and performed in a manner to prevent spread of pathogens.

c. Water accumulation on the floor should be avoided and good floor drainage design should be ensured.

d. Equipment should be maintained and designed to avoid contamination and build-up of organic material.

e. Knives should be cleaned and disinfected between carcasses.

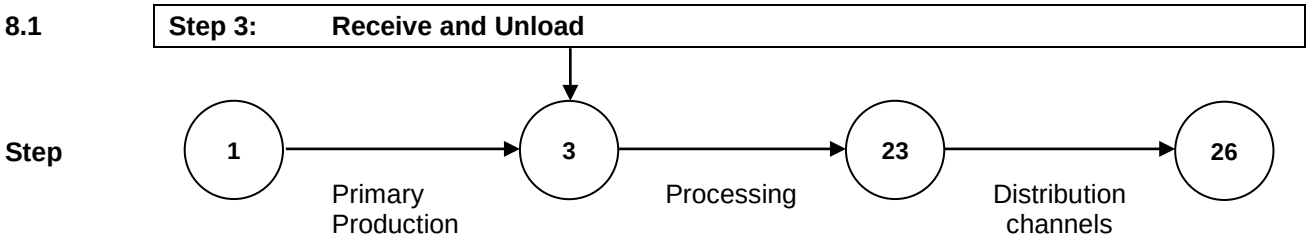
f. Personnel should be trained both on operations and food safety aspects of slaughtering. The line speed should leave adequate time to perform all process steps in the operations.

g. Proper employee hygiene practices should be maintained to prevent the creation of unsanitary conditions (e.g. touching product with soiled hands, tools, or garments). Hygiene should include regular washing of hands to prevent cross-contamination.

h. Water used for decontamination or cleaning and disinfection of equipment should be potable[22]. At steps prior to stunning clean water may be used.

i. Personnel health.

13. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.



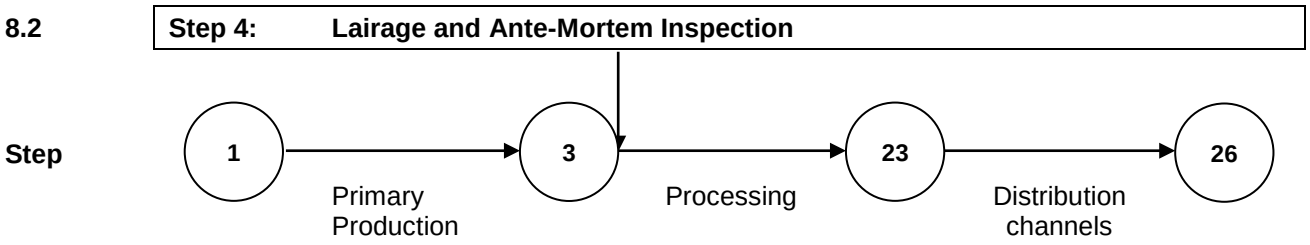
14. This is the point where the pigs arrive at the establishment and the ante-mortem process may begin. There is an increased potential for contamination with enteric pathogens such as *Salmonella* during this time because of their presence in pig´s faeces. Additionally, transportation to the slaughter facility, handling during transport and unloading, and interaction with other pigs may cause stress and increased shedding of pathogens.

8.1.1 GHP-based control measures

15. Loading docks should be maintained clean and should be disinfected as often as practical, taking into account environmental conditions.

16. The availability of food chain information prior to slaughter, e.g. in the form of electronic or paper records would allow food business operators, meat inspectors and risk managers to take steps to minimize cross-contamination during slaughter. Where the *Salmonella* status is known, this information should be communicated to the slaughterhouse before arrival/receiving. Based on this information for the herd, the establishment may choose to segregate and process pigs at the end of the production day. Additional measures such as reduction of the slaughter speed as well as other control measures could be considered.

17. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code* and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).



18. This is the point where the pigs are held before slaughter. There is an increased potential for contamination with *Salmonella* during this time because of their presence in pig's faeces. Additionally, interaction with other pigs may cause stress and increased shedding of pathogens.

8.2.1 GHP-based control measures

19. Refer to relevant Chapters of the OIE *Terrestrial Animal Health Code* and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005).

20. Proper cleaning and disinfection of holding pens should be ensured. The design and maintenance at lairage should also be appropriate to allow effective cleaning process.

21. Care should be taken to control pest animals (e.g. birds and rodents) in the lairage areas in order to reduce the cross-contamination by these animal vectors.

22. Applying a water shower in the holding pens may reduce the accumulation of dust and dirt particles that may carry *Salmonella*. Ensure that pigs are dry enough to prevent dripping at the time of stunning.

23. Time spent at lairage and stocking density should be kept to a minimum.

[22] *General Principles of Food Hygiene* (CAC/RCP 1-1969).

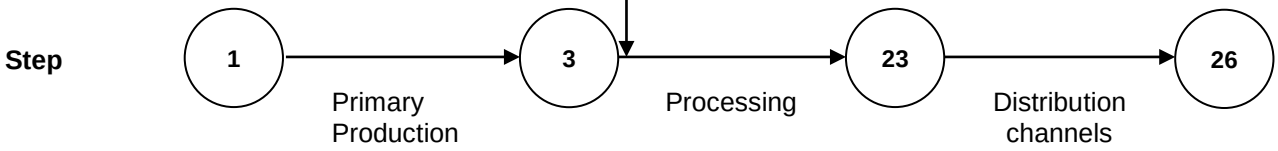
24. Feed should be withdrawn before slaughter in order to reduce the volume of intestinal contents. This may reduce the risk of intestinal spillage at evisceration.

8.2.2 Ante-mortem Inspection

25. Ante-mortem inspection should be carried out as soon as practicable after delivery of animals to the lairage. Segregation procedures may be needed for animals designated as potentially infected at the farm level or for animals identified as suspected cases of salmonellosis to minimize contamination.

26. Also refer to relevant Chapters of the OIE *Terrestrial Animal Health Code*.

8.3 **Step 5: Stunning**

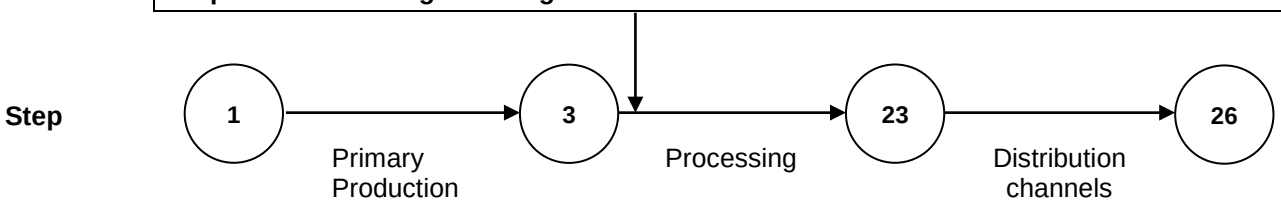


27. This is the point where the pig is rendered unconscious. This can result in a shedding reflex and become a cross-contamination point due to animal contact with the ground after stunning.

8.3.1 GHP-based control measures

28. In case of shedding reflex, faeces should be removed in a sanitary manner.

8.4 **Step 6: Sticking/Bleeding**

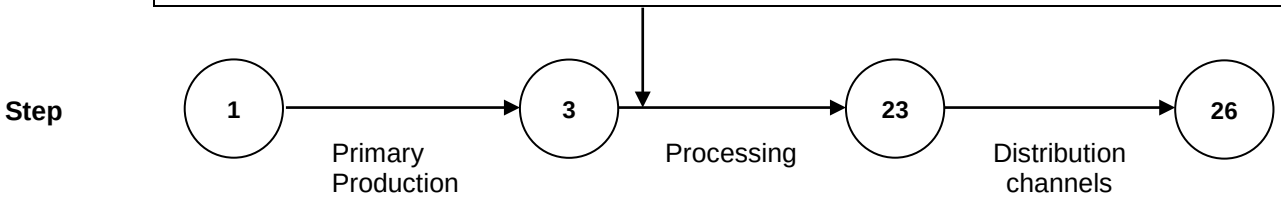


29. This is the point in the process where the animal is bled. Regardless of the slaughter method, it is important for the establishment to minimize contamination of the carcass during any cut made at this step.

8.4.1 GHP-based control measures

30. Measures should be taken to avoid cross-contamination; cleaning and disinfection of the processing environment should be maintained and carcass contact with the floor while being transferred to the line should be avoided.

8.5 **Step 7: Scalding**



31. This is the point in the process where the carcass is sprayed with or immersed into hot water to facilitate the removal of hair and hooves in the succeeding step. Scalding can efficiently reduce *Salmonella* prevalence; however, at an inappropriate temperature, or in the presence of organic matter in the water, scalding can be a source of *Salmonella* contamination of carcasses. This may be a particular concern with contamination of the pig's pharynx, as subsequent carcass decontamination steps would not address this internal contamination.

8.5.1 GHP-based control measures

32. As the cleanliness of the pigs and the microbiological status of the scald water are factors that are significantly associated with the presence of *Salmonella* on the carcasses at the end of the slaughter process, the following measures or equivalent processes should be considered:

a. Sanitary conditions should be maintained. Ensure that the scalder is easy to clean and in good condition and repair. Accumulations of hair and protein in the scalder should be prevented where possible and should be removed before and during operations as needed to maintain sanitary conditions. Condensation should also be controlled as needed. Drain and clean the scalder at least once a day. Pay particular attention to seams weld sites and rough, scratched areas in the interior of the tank to ensure adequate cleaning.

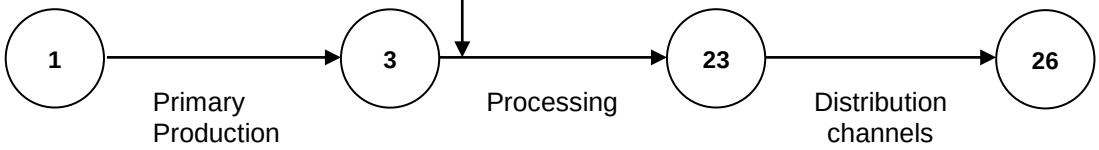
b. A clean supply of water should be maintained. Recirculation of water may result in greater accumulation of hair and residue and affect the control of temperature fluctuations. Re-use of the scalding tank water in multiple processing batches was associated with a higher *Salmonella* prevalence on carcass swabs. The scald water should be changed at least once a day to prevent organic load build up. Use counter current water flow (fresh or recirculated scald water that flows into the scalder in an opposite direction from that of the carcasses) to increase heating efficiency and water cleanliness.

c. Vertical scalding using steam may improve the bacteriological quality of the meat and prevent bacterial contamination of lungs. A vertical steam scald at 100°C allows for a constant supply of clean steam and prevents the accumulation of organic load as opposed to a water system.

8.5.2 Hazard-based control measures

33. Scalding efficiently reduces *Salmonella* on carcasses. There is evidence of prevalence reduction from 35% of carcasses to 1.5% (range 8-1%). Scalding water temperature should be at least 61°C for 8 minutes or 70°C for 2-3 minutes or another combination of time and temperature that can achieve an equivalent *Salmonella* reduction[23].

8.6 **Step 8: Dehairing**



34. This is the point in the process where the hair is removed from the animal. During dehairing manure is pressed out of the rectum and accumulation of manure and growth of *Salmonella* in the equipment can occur. Among the operations carried out in the unclean area, dehairing and singeing/flaming operations especially affect the number of *Salmonella* on the rind side of the carcass. The combined effect of these two operations can lead to a low prevalence of *Salmonella* after the unclean area. *Salmonella* has been detected in air samples at the locations of dehairing and evisceration operations.

8.6.1. GHP-based control measures

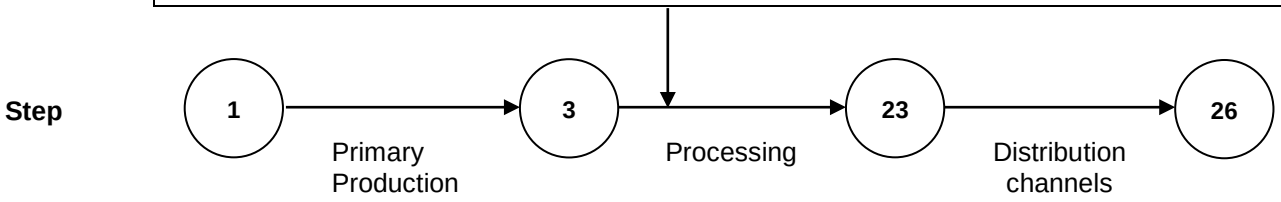
35. Accumulation of hair in the dehairing equipment should be prevented and removed and sufficient water supply should be ensured as necessary, to maintain sanitary conditions.

36. At the end of the shift, all organic material and debris from dehairing equipment should be removed. Consider the importance of mechanical action and cleaning. Chemical cleaners and disinfectants should be selected based on several factors including but not limited to the nature of dirt, equipment materials and water hardness.

37. Special care should be taken to prevent recontamination and increases in bacterial load when using a dehairing machine.

[23] For all numerical values in hazard-based measures, refer to Interventions for the Control of Nontyphoidal *Salmonella* spp. in Beef and Pork. Report of the Joint FAO/WHO Expert Meeting, 2015.

8.7 **Step 9: Gambrelling**

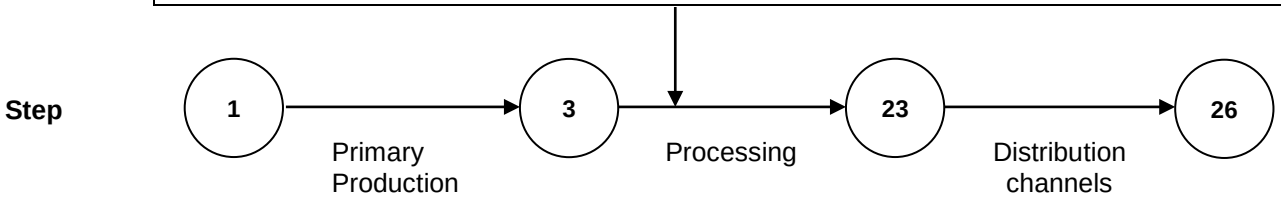


38. Gambrelling is the process of hanging the carcass by the hind legs on hooks.

8.7.1 GHP-based control measures

39. When gambrel tables are used, carcass contamination should be minimized by cleaning and disinfecting gambrel table when needed to remove fecal materials before processing is resumed.

8.8 **Step 10: Singeing**



40. This is the point in the process where the carcass surface is subjected to direct-fire bursts in order to improve the hair removal and reduce or eliminate the pathogens of skin surface. Singeing has been identified as one of the most important steps for reducing microbial contamination on the surface of pig carcasses, including *Salmonella*.

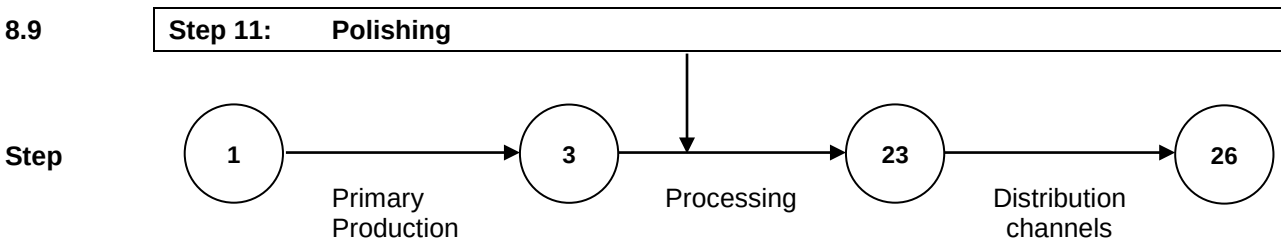
8.8.1 GHP-based control measures

41. Singeing is more effective on drier carcasses.

8.8.2 Hazard-based control measures

42. Singeing can achieve a reduction of *Salmonella* prevalence from 18% pre-treatment to 5% post-treatment (95% confidence interval 3-9) and a 2 $\log_{10}$ CFU/cm^2 reduction in *Salmonella* concentration. The reduction depends on the intensity of the singeing/flaming and the time used. Increasing time spent in the singeing unit was associated with lower *Salmonella* prevalence in carcass swabs. Singeing temperature should be homogeneous on the carcass as areas such as the base of the ears might not reach the required temperature to inactivate *Salmonella*.

8.9 **Step 11: Polishing**



43. This is the point in the process where the carcass is subjected to the mechanical finishing process of remaining and burned hairs by the previous step. This step aims to eliminate the waste, but polishing is a primary mode of pork carcass recontamination following reductions achieved during singeing. Any surviving bacteria may be mechanically disseminated by stainless steel scrapers or nylon brushes used in polishing.

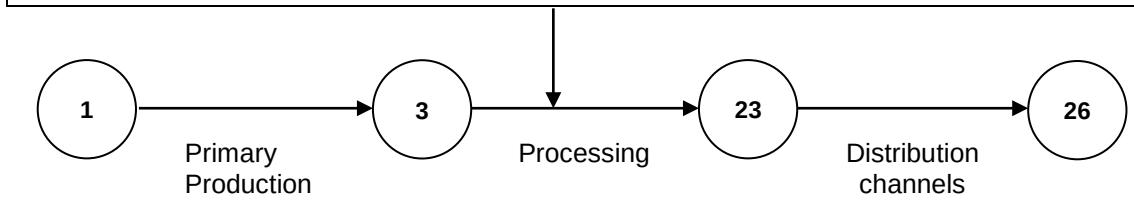
8.9.1 GHP-based control measures

44. Polishers should be cleaned thoroughly because they harbour bacteria and allow them to multiply to high numbers. Thorough cleaning and disinfection of the equipment as needed and at the end of the shift will minimize the potential for carcass cross-contamination.

45. After polishing and before passing the carcasses on to the clean area (bunging) a measure should be in place to prevent visibly contaminated carcasses from being passed on. Steam or hot water vacuum is acceptable to remove faecal contamination. If steam vacuuming is not available, knife trimming can be used to remove faecal contamination and other dressing defects.

46. If necessary an additional singeing step, after polishing, may be added to reduce contamination introduced by polishing. Consideration should be given as to whether carcasses have been adequately reconditioned in a sanitary manner, if contaminated by faeces voided during the gambrelling step.

8.10 **Step 12: Bunging**



47. This is the point in the slaughter process where a cut is made around the rectum (i.e. terminal portion of the large intestine) to free it from the carcass, and then it is tied off or an automated bunging system is used to prevent spillage of faecal material.

8.10.1 GHP-based control measures

48. When bunging, tie the bung, cut it free from surrounding tissues with a single incision, and avoid contaminating surrounding tissue. If possible, use an automated bunging system instead of manual bung tying, which will reduce cross-contamination by going around the anus and evacuating the rectum.

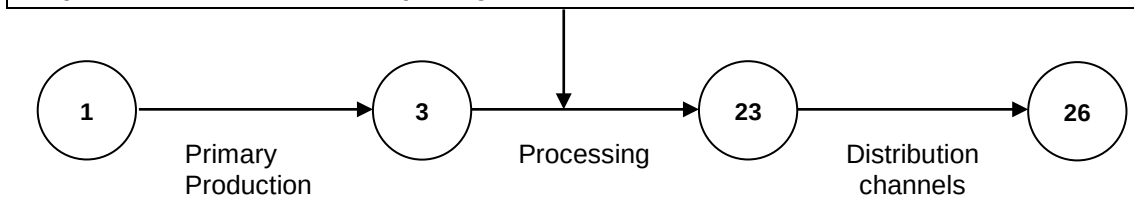
49. During separation, prevent contact of bung with carcass or with viscera. A plastic bag can be used to avoid spilling from rectum. Secure bag with a tie or clip.

50. Immediately remove any contamination that results from bunging.

51. Clean and disinfect bung guns, knives, and hooks between each carcass.

52. Prevent contaminated water from dripping down the back of the carcass.

8.11 **Step 13: Midline/Brisket Opening**



53. This is the point in the process where the brisket is split (i.e. cut along the centre line).

8.11.1 GHP-based control measures

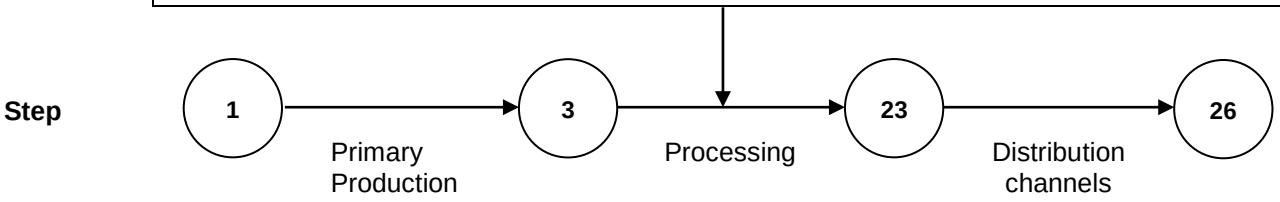
54. Measures to prevent the introduction of contamination into the carcass during brisket opening include:

a. Cleaning and disinfecting the brisket saw and knife between each carcass and ensuring that the gastrointestinal tract is not punctured.

b. Maintaining proper employee hygiene practices to prevent the creation of unsanitary conditions (e.g. touching the carcass with soiled hands, tools, or garments).

c. If the gastrointestinal tract has been punctured causing a major contamination the carcass should be identified and additional procedures to avoid cross-contamination should be performed.

8.12 **Step 14: Evisceration**



55. This is the point in the process where the removal of the viscera (e.g. the edible offal that includes the heart, intestines, stomach, liver, spleen, and kidneys when presented with viscera) occurs. If the viscera are not handled properly, or if employee hygiene practices are not being followed, contamination of the carcass and edible offal can occur.

8.12.1 GHP-based control measures

56. Evisceration should be performed carefully to minimize cross-contamination from intestinal contents. Trained and experienced individuals should perform the evisceration; this is particularly important at higher line speeds.

57. Measures to ensure that employees do not contaminate carcasses during evisceration can include:

a. Properly using knives to prevent damage (i.e. puncturing) to the gastrointestinal tract.

b. Maintaining proper employee hygiene practices (e.g. wash hands and arms often enough to prevent contamination of the carcass).

c. Using footbaths or separate footwear by employees on moving evisceration lines to prevent contaminating other parts of the operation.

58. To prevent contamination of the carcass or viscera, the rectum should be tied before evisceration. The pluck should be removed along with the oesophagus and viscera attached (so there is no leakage).

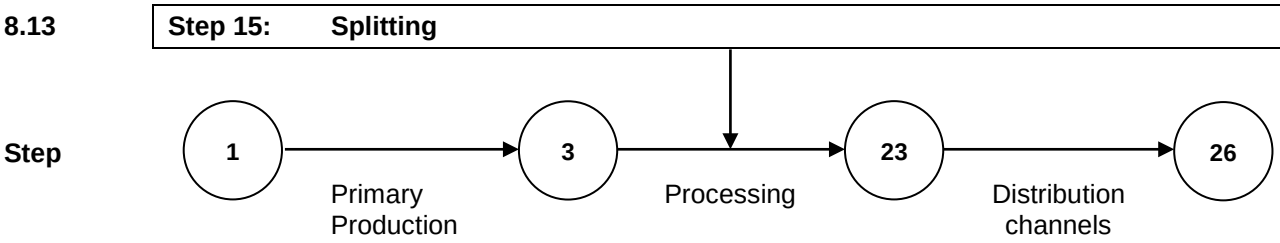
59. Cutting through tonsils should be avoided because of the risk of spreading *Salmonella* from tonsil tissue.

60. When removing stomach and intestines, a minimum of 2 cm of oesophagus should be left on the stomach to minimize leakage of stomach contents.

61. Cutting or rupturing of the gut should be avoided. The critical operations are: cutting around the rectum, removal of the intestinal tract, and removal of the pluck.

62. Carcasses with visual contamination should be removed from the line and sent for reconditioning (knife trimming or steam vacuuming) before carcass splitting.

8.13 **Step 15: Splitting**



63. This is the point in the process where carcasses are split vertically into two halves.

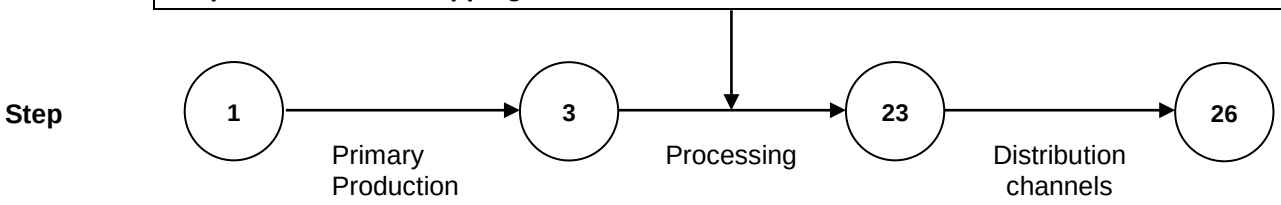
8.13.1 GHP-based control measures

64. Care should be taken to avoid cross-contamination, which may occur when carcass splitting saw blades come in contact with the throat.

65. Carcass splitting equipment should be cleaned and disinfected during and after each carcass or as appropriate.

66. When using two blade axe systems, contamination build-up between blades should be controlled by regular cleaning and disinfection with hot water. Cross-contamination should be avoided by allowing adequate distance between carcasses (i.e. avoid carcass-to-carcass contact) and walls and equipment.

8.14 **Step 16: Head Dropping/Removal**



67. This is the point in the slaughter process where the head is totally or partially removed from the carcass. It is important to maintain sanitary conditions because cross-contamination can occur if the head comes into contact with other carcasses or heads, equipment and employees. Between this step and chilling is where decontamination treatments are likely to be most effective.

8.14.1 GHP-based control measures

68. The ingesta, bile, or other contaminants should be removed by flushing the oral cavity before head dropping and head inspection.

69. Knives and head dropping equipment should be cleaned and disinfected between carcasses and whenever sectioning of the oesophagus occurs.

70. Personnel should be aware of potential contamination of the head, neck, and carcass by knives or equipment after incision of the oral-pharyngeal cavity or from exposure to fresh stomach contents when dropping heads and processing of head and cheek meat.

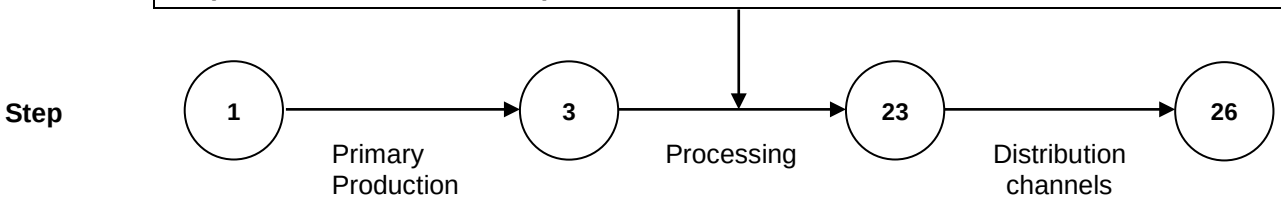
71. When a contaminated carcass is not adequately cleaned before the final wash, the carcass should be diverted to a holding rail until cleaned or reconditioned.

72. Measures to minimize contamination of heads, equipment, and employees can include:

a. Removing heads in a manner that avoids contamination with digestive tract contents.

b. Limiting the splashing of water when washing heads in order to prevent cross-contamination and to limit airborne contaminants.

8.15 **Step 17: Post-Mortem Inspection**



73. This is the point in the process where inspection of carcasses is carried out.

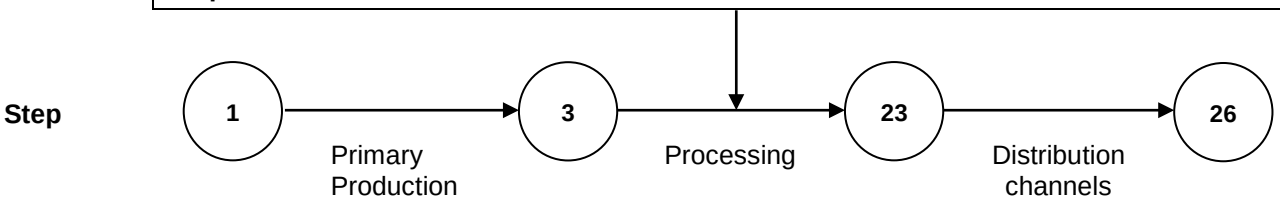
8.15.1 GHP-based control measures

74. The need for routine palpations and incisions during post-mortem inspection should be weighed against the potential impact on cross-contamination with *Salmonella* through the application of these techniques.

75. Line speeds and the amount of light should be appropriate for effective post-mortem inspection of carcasses.

76. The procedures should be planned to avoid cross-contamination. Touching the carcasses with hands, tools or garments may cause cross-contamination.

8.16 **Step 18: Pre-chill Treatment**



77. At this stage in the process, the carcass may be subjected to a treatment in order to remove *Salmonella* and other contaminants from the surface of the carcass prior to entering the chilling room. The treatment may be also applied at other suitable stages.

8.16.1 GHP-based control measures

78. Full carcass steam-vacuum treatment can be a valuable approach for small slaughterhouses as an alternative to whole carcass thermal treatments. The efficacy to reduce *Salmonella* can be highly variable depending on how it is applied and is related to the training of the operator.

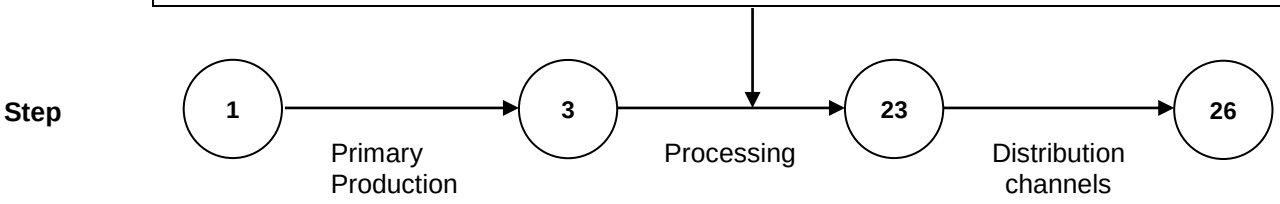
8.16.2 Hazard-based control measures

79. The following decontamination treatments have shown significant reductions of *Salmonella* on the carcass.

80. Thermal treatments reduce the prevalence and concentration of *Salmonella*. Hot water at 74 to 81°C for 5 to 15 seconds and steam at 82-85 °C for 60 seconds have been shown to reduce the prevalence of *Salmonella* from 13% pre-treatment to 1% post-treatment. Thermal treatments that achieve a carcass surface temperature of at least 70°C would be expected to achieve up to 2 $\log_{10}$ CFU/cm^2 reduction of the *Salmonella* concentration on the carcass. Time-temperature combinations required to achieve a specific reduction are specific to the establishment.

81. Organic acid treatments, such as lactic or acetic acid washes can significantly reduce *Salmonella* prevalence on carcasses. Studies have shown that organic acid treatments reduce prevalence of *Salmonella* from 8% pre-treatment to 2% post-treatment. Organic acid treatments should be applied uniformly over the carcass at combinations of concentration, time, duration of contact time, and temperature to achieve the intended reduction. Washing concentrations need to be measured at the site of application. Concentrations required to achieve a specific reduction are specific to the establishment and vary between acids. Contact time of washes may need to be considered, especially if followed by a rinse step. Organic acid treatments would be expected to achieve up to 0.5 to 1 $\log_{10}$ CFU/cm^2 reduction of the *Salmonella* concentration on the carcass.

8.17 **Step 19: Chilling**



82. This is the point in the process where the carcass is chilled.

8.17.1 GHP-based control measures

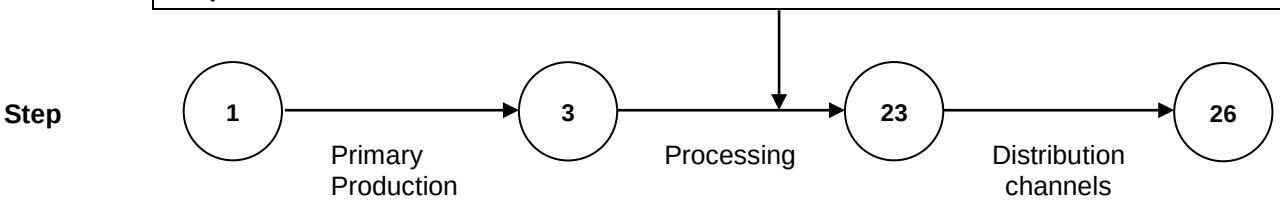
83. Chilling inhibits the growth of *Salmonella*. The effect of chilling depends on carcass spacing, air-flow, and cooling capacity. Carcasses should be adequately spaced to allow for effective cooling and prevention of cross-contamination.

84. Sanitary conditions should be maintained in the chilling room.

85. Effective temperature control should be implemented to achieve and maintain a carcass surface temperature to prevent the growth of *Salmonella*.

86. Blast chilling involves initial blasting carcasses with air at temperatures below -15°C resulting in a surface that is frozen. Freezing of the surface during blast chilling may yield better reductions in the prevalence of *Salmonella* on carcasses.

8.18 **Step 20: Carcass Fabrication**



87. These steps include cutting and deboning that can result in wholesale pieces.

8.18.1 GHP-based control measures

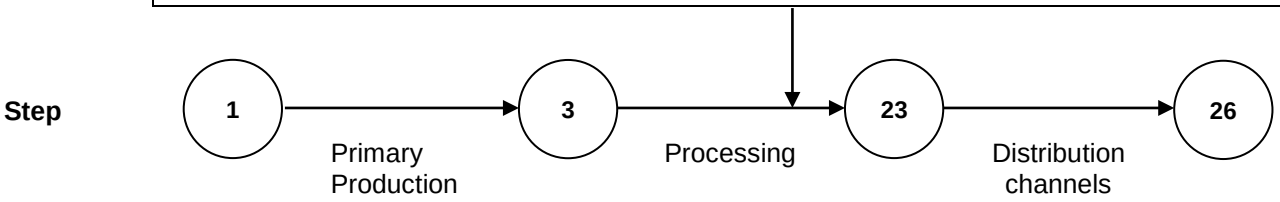
88. Boning and fabrication rooms should be kept at a temperature that limits the ability for *Salmonella* to grow.

89. In order to reduce time out of chilling room, and to limit the growth of *Salmonella*, a reasonable flow of products should be ensured.

90. Knives, saws, slicers, and other food contact surfaces should be cleaned and disinfected as frequently as necessary to prevent the creation of unsanitary conditions.

91. Airflow should be controlled to prevent cross-contamination from slaughter operations e.g. positive air pressure in carcass fabrication area relative to other areas in the slaughter operations.

8.19 **Step 21: Mechanical Tenderization/ Mincing**



92. This is the point in the process where the meat is subjected to the process of breaking fibres mechanically or manually. This step can be a cross-contamination point if the procedures and handling are not performed in a sanitary manner and by trained and experienced employees.

8.19.1 GHP-based control measures

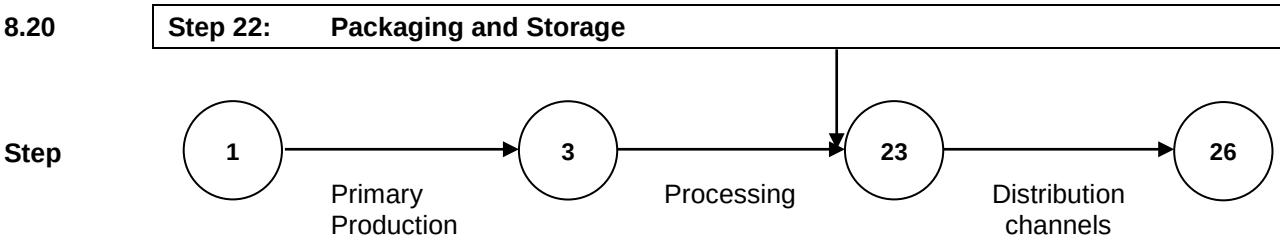
93. Products should be stored at temperatures to prevent the growth of *Salmonella*.

94. Equipment used for this operation should be adequately maintained and adjusted.

95. In order to avoid cross-contamination, equipment and environment should be cleaned on a regular basis and good personal hygiene practices should be followed by employees.

96. Processes such as mechanical tenderization or mincing, may potentially increase contamination in the meat. There should be increased awareness of the risk of contamination when handling of the meat throughout the rest of the food chain.

8.20 **Step 22: Packaging and Storage**



8.20.1 GHP-based control measures

97. Packaging rooms should be kept at a temperature that limits the growth of *Salmonella*.

98. Use of various technology packaging may limit the growth of *Salmonella*.

99. The storage room should be maintained at a temperature that prevents the growth of *Salmonella*.

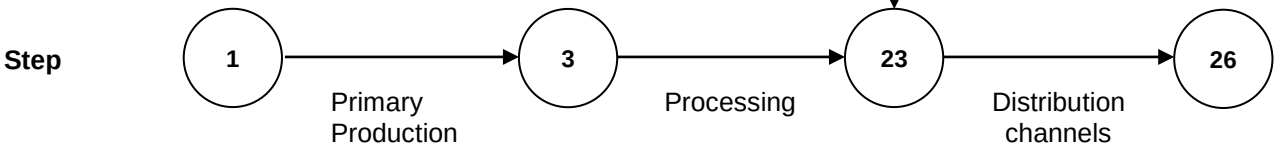
100. The temperature of the packaging and storage rooms and meat should be monitored and documented.

8.20.2 Hazard-based control measures

101. Various doses of ionizing radiation have been shown to be effective at eliminating *Salmonella* in warm, chilled or frozen pork. Application and control of the process should take into consideration the *General Standard for Irradiated Foods* (CODEX STAN 106-1983) and the *Code of Practice for Radiation Processing of Foods* (CAC/RCP 19-1979). Irradiation of minced pork meat has resulted in D-values of 0.403–0.860 kGy for *S. typhimurium*.

9. CONTROL MEASURES FOR STEPS 23 TO 26 (DISTRIBUTION CHANNELS)

9.1 Step 23: Transport to Distribution Channels



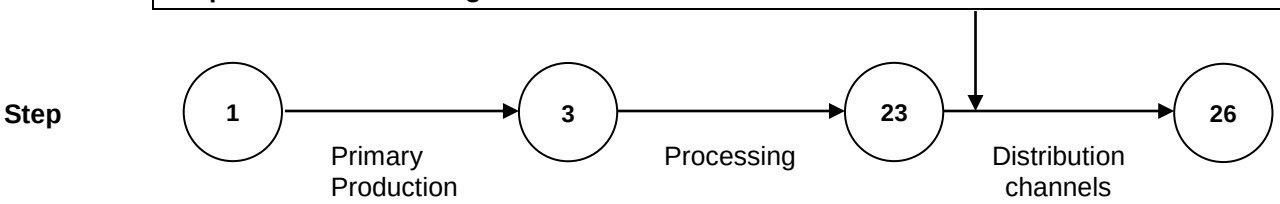
9.1.1 GHP-based control measures

102. Transportation vehicles should be kept clean and free of pests.

103. Transportation vehicles should be maintained at a temperature that ensures the temperature of the chilled meat is adequate to prevent the growth of *Salmonella*.

104. Temperature of vehicle and meat should be monitored and documented. Meat should be chilled before loading onto the vehicle for transport.

9.2 Step 24: Cold Storage

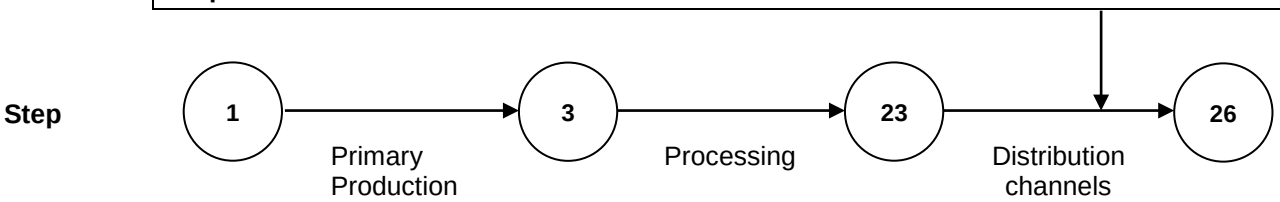


9.2.1 GHP-based control measures

105. Storage room temperature should be maintained at a temperature that prevents the growth of *Salmonella* in the chilled meat

106. Storage room temperature should be monitored and documented.

9.3 Step 25: Distribution/Retail



9.3.1 GHP-based control measures

9.3.1.1 Retail

107. Fresh meat should be held at a temperature that prevents the growth of Salmonella.

108. The temperature of the storage room and display cases should be monitored and documented.

109. Cross-contamination from or to other food items should be prevented.

110. Food business operators serving meat for direct consumption to consumers (e.g. caterers, restaurateurs) should take appropriate measures to:

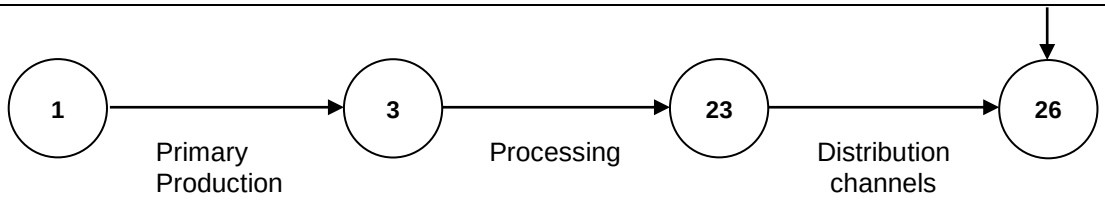
a. Prevent cross-contamination.

b. Maintain appropriate storage temperature.

c. Ensure proper cleaning.

d. Ensure proper cooking.

9.4 **Step 26: Consumer**



9.4.1 GHP-based control measures

111. Consumers should be informed about the potential risk associated with finished pork product in order to follow instructions and make informed choices on how to avoid the spread and growth of *Salmonella* (e.g. storage, thawing and cooking temperatures, hygiene including hand washing). The WHO Five Keys to Safer Food[24] assists in this process.

112. Cooking of pork can reduce or eliminate *Salmonella*.

113. Consumers should be appropriately informed of raw treated meat (e.g. mechanically tenderized, minced meat) so they can take appropriate actions to make sure meat is properly cooked.

114. Special attention should be paid to the education of all persons preparing food, and particularly to those preparing food for the young, old, pregnant and immuno-compromised.

115. Consumers should wash and disinfect food contact surfaces and utensils after raw pork preparation to significantly reduce the potential for cross-contamination in the kitchen.

116. The above information to consumers should be provided by the competent authorities, local government, health agencies, manufacturers, retailers or other consumer sources and through multiple channels such as national media, health care professionals, food hygiene trainers, product labels, pamphlets, school curricula and cooking demonstrations.

[24] http://www.who.int/foodsafety/consumer/5keys/en/

Appendix III

PROPOSED DRAFT GUIDELINES ON THE APPLICATION OF GENERAL PRINCIPLES OF FOOD HYGIENE TO THE CONTROL OF FOODBORNE PARASITES

(N03-2014)

(at Step 5/8)

INTRODUCTION

1. Foodborne parasites are a major public health burden worldwide[1], particularly in areas with poor sanitary facilities and in populations that traditionally consume raw and undercooked food dishes. Infections may have prolonged, severe, and sometimes fatal outcomes, and result in considerable hardship in terms of food safety, security, quality of life, and negative impacts on livelihood.

2. The joint Food and Agriculture Organization of the United Nations (FAO)/ World Health Organization (WHO) report on *Multicriteria-Based Ranking for Risk Management of Foodborne Parasites*[2] lists 24 parasite species, genera or families that ranked highest in global public health concern. The top 8 highly ranked parasites are *Taenia solium*, *Echinococcus granulosus*, *Echinococcus multilocularis*, *Toxoplasma gondii*, *Cryptosporidium* spp., *Entamoeba histolytica*, *Trichinella* spp, and *Opisthorchiidae*. The ranking was based on 7 criteria of which 5 were public health related. The ranking was based on worldwide impacts and regionally other foodborne parasites may be more important. The ranking indicates that the foodborne parasites of greatest concern from a global public health perspective are not limited to a single parasite group or a food vehicle, but span a number of different parasites groups, and food vehicles.

3. Knowledge of parasite life cycles, transmission routes and environmental requirements is needed to understand which control measures may be effective. Foodborne parasites are transmitted to humans by ingestion of fresh or processed foods that are contaminated as a consequence of the parasite's life cycle (e.g. meat that contains *Trichinella* larvae or *Toxoplasma* tissue cysts) or that are contaminated with soil or water carrying infective stages of parasites (e.g. cysts, oocysts, eggs). In the first case, human infection can occur through the consumption of an infective stage in raw, undercooked or poorly processed meat and offal from domesticated animals, game, fish, crustaceans, cephalopods and molluscan shellfish. In the second case, human infection can occur from ingestion of infective stages in water and on foods such as fresh fruit and vegetables resulting from animal or human faecal contamination (e.g. oocysts of *Cryptosporidium* spp. in fresh vegetables).

4. Control of foodborne parasites can be achieved through the prevention of infection of farmed food animals (e.g. livestock, poultry, fish) with infective stages, the prevention of contamination of fresh and processed foods with infective stages, and/or the inactivation of parasites in or on foods during processing. Control during primary production is important for many parasite/food combinations, while control measures during post-harvest are necessary for other parasite/food combinations. During a parasite hazard analysis, producers should consider how the product will be further processed, prepared and consumed in order to determine appropriate parasite control measures. Education and awareness-raising are important components of consumer protection from foodborne parasitic diseases and, in many cases, may be the only feasible option available.

5. The first step of foodborne parasite risk management should be identifying any potential parasite hazard(s) applicable to the food being produced[3]. The details of the epidemiology (both human and animal disease) and the life cycle of each parasite are essential in the identification, prevention and control of the risks associated with that parasite. Epidemiological data collection in food and environmental parasite surveys can be effective in identifying hazards and collecting information to be used for risk management strategy decisions. Surveillance for parasitic diseases in humans is complicated by the often prolonged incubation periods, sub-clinical nature, unrecognized chronic sequelae and lack of easily available diagnostic procedures.

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[1] WHO FERG report (2015)

[2] FAO/WHO. 2014. Multicriteria-based ranking for risk management of food-borne parasites. Microbiological Risk Assessment Series No. 23. Available at http://www.fao.org/3/a-i3649e.pdf and http://www.who.int/foodsafety/publications/mra_23/en/

[3] *Principles and Guidelines for the conduct of Microbiological Risk Management (MRM)* (CAC/GL 63-2007).

6. The occurrence and distribution of parasitic species in the raw commodities used for food can be affected by climate changes, land use, and other environmental factors. The spread of foodborne parasitic diseases is also affected by human behaviour (for instance, environmental contamination by human faeces due to the lack of latrines and human-to-human contact that spread parasite eggs and cysts), demographics, and global trade. For example, globalization of food trade offers new opportunities for parasite dissemination into new areas.

SECTION 1 - OBJECTIVES

7. The primary purpose of these guidelines is to provide guidance on preventing, reducing, inactivating, or otherwise controlling foodborne parasite hazards that present a public health risk. The guidelines provide science-based advice to governments and the food industry with the aim of protecting the health of consumers against foodborne parasites and ensuring fair practices in food trade. The guidelines also provide information that will be of value to consumers and other interested parties.

SECTION 2 - SCOPE, USE AND DEFINITION

2.1 SCOPE

8. These guidelines for the control of foodborne parasites are applicable to all foods especially those foods identified in the FAO/WHO report, from primary production through consumption. They should complement guidelines in place for any other pathogens (e.g. bacteria and viruses).

9. Control measures should be applied to parasite hazards in proportion to the public health risk. Countries in which specific parasites are endemic should take special measures to reduce the identified risk.

10. Section 3 is subdivided into four food categories: i) Meat and meat products, ii) Milk and milk products, iii) Fish and fishery products, iv) Fresh fruits and vegetables. The Scope of these categories is the same as provided in the following codes:

- Meat and Meat products: *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005), especially raw or undercooked meat.
- Milk and Milk products: *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004), especially, unpasteurized milk and milk products.
- Fish and Fishery products: *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003), especially, raw or undercooked fish and fishery products.
- Fresh Fruits and Vegetables: *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53- 2003), especially fruits and vegetables consumed raw or undercooked.

11. The remaining sections contain guidelines applicable to the food chain after primary production (i.e. processing, food service, home preparation, and consumption), but are not subdivided into food categories.

2.2 USE

12. These guidelines follow the format of the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and should be used in conjunction with it and other relevant codes of practice such as:

- *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005),
- *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004),
- *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003),
- *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003)

13. The World Organization for Animal Health (OIE) develops standards for the prevention, detection and control of some foodborne parasites at the primary production stage. Therefore, these guidelines should also be used in conjunction with relevant Articles of the OIE Codes and Manuals and the OIE/FAO guide to Good Farming Practices for Animal Production Food Safety.

14. Flexibility in application of the Guidelines is important. They are primarily intended for use by government risk managers and industry in the design and implementation of food control systems.

2.3 DEFINITIONS

15. Definitions relevant to these guidelines include:

Fish[4]

Aquaculture4

Feed[5]

Fish farm4

Cyst – A transmission stage of a parasite that can cause infection when consumed. Environmental cysts are resistant to outside conditions and can be transferred with soil, dust, and water to food. Tissue cysts are located within animal tissues.

Foodborne Parasite – Any parasite that can be transmitted to humans by ingesting food.

Host – An organism which harbours the parasite.

Larvae – Immature form of helminths, before the development of the mature stage. Larvae can be infective or not.

Oocyst – The environmental, developmental stage of coccidian parasites, produced through sexual reproduction in the definitive host. Oocysts can be infective or not when produced or shed.

SECTION 3 - PRIMARY PRODUCTION

16. It is necessary to conduct a hazard analysis to identify the foodborne parasite hazards that could be present in the feed and food production environment and that may contaminate foods during primary production. Control of parasites during primary production is particularly important when subsequent control steps during processing may not be adequate to eliminate the hazard or reduce it to an acceptable level.

17. Sources of parasitic contamination of food and food producing animals at the primary production site include feed, water, soil, workers, untreated manure, sludge or fertilizers contaminated by faeces of human and/or domestic and wild animals, or proximity to other activities which could result in run-off or flooding with contaminated water. Therefore, attention to water quality throughout the food-chain, from primary production through processing to consumption is very important. In addition to the above, food-producing animals feeding on other live and dead animals (e.g. mammals, fish, birds, invertebrates), are important sources of parasitic infections.

18. Farm workers in endemic areas may be infected with parasites without feeling ill or showing any symptoms. In order to minimize the probability for contamination of the production environment with parasitic stages from human faeces, on-farm sanitary facilities should be installed and used, e.g. functional latrines in the field that do not leak contaminants into the primary production area, and an adequate means of hygienically washing (e.g. scrubbing under running water) and drying hands. Waste from sanitary facilities should be hygienically disposed of in such a way as to eliminate contact of potentially infectious faeces with animals or pasture land.

A. Meat and Meat Products

19. Important meat-transmitted foodborne parasites include, but are not limited to, *Taenia solium* (pigs), *Toxoplasma gondii* (pigs, cattle, chickens, sheep, goats, horses, game), *Trichinella spiralis* (pigs, horses, game) and other *Trichinella* spp. (pigs, horses and game), *Taenia saginata* (cattle), *Sarcocystis* spp. (pigs, cattle) and *Spirometra* spp.(fish, reptiles, and amphibians). Certain foodborne parasites present in domestic animals may be transmitted to food of plant origin via faecal contamination (e.g. *Echinococcus* spp., *Cryptosporidium* spp., *Fasciola* spp. and *Giardia duodenalis*.) These parasites are not associated with human illness from consumption of meat, however they should be controlled in animal production in order to interrupt their life cycle. For information on specific food vehicles for these parasites, see Table 2 in FAO/WHO report on *Multicriteria-Based Ranking for Risk Management of Food-Borne Parasites*2.

3.1 ENVIRONMENTAL HYGIENE

20. Refer to Section 3.1 of the *General Principles of Food Hygiene* (CAC/RCP 1-1969), and Section 5.5 of the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005) and the relevant Chapters of the *OIE Terrestrial Animal Health Code*[6] .

[4] *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003)
[5] *Code of Practice on Good Animal Feeding* (CAC/RCP 54-2004)
[6] Refer to the OIE website: http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/.

21. Faeces of domestic and wild animals (e.g. *Toxoplasma* oocysts in felids), as well as human faeces (e.g. *Taenia* eggs), may contain parasites that are infective to domestic food-producing animals. Some parasites may also be transmitted to domestic animals or other animal hosts when these animals eat infected tissues from other animals. Where parasites will not be controlled at a later processing stage, the feasibility of controlling environmental introduction of foodborne parasites during primary production with available methods should be determined before primary production begins. The risk associated with the introduction of organic material (e.g. faecal and other material that may contain oocysts or eggs) from non-food-producing animals into the production environment should also be assessed.

22. Game meat may contain parasites that infect humans directly or via the infection of livestock. The environment of wild animals and open range domesticated animals cannot be controlled, therefore, mitigation measures should be in place to minimize the risk at a later stage in the food chain.

3.2 HYGIENIC PRODUCTION OF FOOD SOURCES

23. For information related to the control of parasites related to animal feed, refer to the *Code of Practice on Good Animal Feeding* (CAC/RCP 54-2004), Sections 4, 5 and 6.5 of the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005), and the relevant Chapters of the *OIE Terrestrial Animal Health Code* , and the WHO/FAO/OIE Guidelines for the surveillance, prevention and control of taeniosis/cysticercosis[7], and FAO/WHO/OIE Guidelines for the surveillance, management, prevention and control of trichinellosis[8].

24. Where indicated by a hazard analysis, control measures and/or hygienic practices should be implemented that prevent foodborne parasites from contaminating foods or infecting food animals during primary production, or that reduce contamination to an acceptable level.

25. Fully enclosed animal housing systems, or other systems that prevent intrusions of potentially contaminated small animals or unauthorized people, combined with other good production practices, can be effective in controlling foodborne parasite hazards in meat, since such systems have been demonstrated to be effective for a number of parasites (e.g. *Trichinella* spp., *Toxoplasma*).

26. Feed should be effectively protected against rodents (e.g. *Trichinella* spp. control), cats (e.g. *Toxoplasma gondii* control) and other animals. All dead animals should be immediately removed from feed storage and food-producing animal production areas and disposed of in a safe manner.

27. Primary producers should supply water that is not a significant source of transmission of foodborne parasites to food-producing animals and to the extent possible block access of food producing animals to surface water and untreated water collection systems to minimize the potential for infection with parasites.

28. In order to assess whether foodborne parasite controls at primary production are properly implemented and effective, control measures should be documented and verified. Animal surveillance may be a useful tool for assessing control measure needs/shortcomings; however, because of the practical limitations of sampling and testing methodology, testing cannot assure the absence of a parasite hazard.

3.3 CLEANING, MAINTENANCE AND PERSONNEL HYGIENE AT PRIMARY PRODUCTION

29. Refer to the relevant Chapters of the *OIE Terrestrial Animal Health Code* for recommendations on cleaning, disinfection and personal hygiene.

3.5 MONITORING AND SURVEILLANCE AT PRIMARY PRODUCTION

30. Refer to the relevant Chapters of the *OIE Terrestrial Animal Health Code*. Surveillance and monitoring of foodborne parasites in food animals and in species that are potential sources of parasites could be effective in developing risk management strategies. Monitoring and surveillance can be useful as tools to verify the effectiveness of parasite controls, and should begin at primary production.

31. Assurance that a parasite hazard is adequately controlled can be attained through demonstration of properly implemented controls and hygienic practices, which may be supported by a series of negative test results over a sufficient time period through a risk-based surveillance programme.

32. It is important to exchange information between the owner of the herds and the slaughterhouse or processing plant e.g.:

- When the status of the herd in relation to parasite infection (e.g. history of parasitic infection) is known, it should be communicated to the slaughterhouse in order to facilitate a more targeted monitoring of parasites in the slaughterhouse.

[7] http://www.oie.int/doc/ged/d11245.pdf
[8] http://www.trichinellosis.org/uploads/FAO-WHO-OIE_Guidelines.pdf

- The status of the meat, following a post-mortem inspection in the slaughterhouse, should be provided to the owner of herds, to facilitate a more targeted control at primary production.

B. Milk and milk products

33. Consumption of unpasteurized milk has been associated with outbreaks of cryptosporidiosis and toxoplasmosis. Contamination of unpasteurized milk with *Cryptosporidium* spp. may result from unsanitary milking conditions, such as when the udders are not properly cleaned. Outbreaks of toxoplasmosis have been associated with the consumption of unpasteurized goat and camel milk. Infective stages of *Toxoplasma* in recently infected animals may be excreted in the milk and might result in milk-borne infection. For information on specific food vehicles for these parasites, see Table 2 in FAO/WHO report on *Multicriteria-Based Ranking for Risk Management of Food-Borne Parasites*2.

3.1 ENVIRONMENTAL HYGIENE

34. Refer to Section 3.1 of the *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004).

35. Cats should be excluded, to the extent possible, from barns and food production, handling and storage areas used for dairy herds (e.g. cows, goats, sheep and camels).

3.2 HYGIENIC PRODUCTION OF FOOD SOURCES

36. Refer to the *Code of Practice on Good Animal Feeding* (CAC/RCP 54-2004) and Section 3.2 of the *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004).

3.3 HANDLING, STORAGE AND TRANSPORT

37. Refer to Section 3.3 of the *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004).

3.4 CLEANING, MAINTENANCE AND PERSONNEL HYGIENE AT PRIMARY PRODUCTION

38. Refer to Section 6 of the *Code of Hygienic Practice for Milk and Milk Products* (CAC/RCP 57-2004).

C. Fish and fishery products

39. Important fish-transmitted foodborne parasites include Opisthorchiidae in freshwater fish, *Paragonimus* spp. in freshwater crustaceans, Anisakidae in marine fish, crustaceans and cephalopods, Heterophyidae in freshwater/brackish water fish, and Diphyllobothriidae in freshwater and marine fish. For information on specific food vehicles for these parasites, see Table 2 in *Multicriteria-Based Ranking for Risk Management of Food-Borne Parasites*, Report of a Joint FAO/WHO Expert Meeting, 2012.

3.1 ENVIRONMENTAL HYGIENE

40. Refer to Sections 6.1.1 and 6.1.2 of the *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003).

41. Wild fish, and aquacultured fish without controlled rearing conditions, may contain parasites that infect people. The environment of wild fish cannot be controlled, requiring measures to be taken at a later stage of the food chain, e.g. processing, for fish that will be consumed raw or undercooked.

42. The source of water used for aquaculture fish farming can be a risk factor for parasitic infections. The larval stages of certain trematodes, which may be present in fish farm water, can penetrate fish skin and infect fish tissues. Aquaculture primary producers should use clean water and seek appropriate guidance on water quality, and should prevent influx of contaminated water (including waste water). The hygienic suitability of the water, under both normal and rain-storm conditions, should be assessed.

43. Where feasible, material derived from on-board evisceration of fish showing signs of infection by parasites communicable to humans should not be disposed of at sea unless it has undergone a treatment that kills the parasites, in order not to maintain the parasite life cycle.

44. Some aquaculture methods may reduce a parasite hazard to an acceptable level, for example, ocean pen-reared salmon that are raised on commercial pelleted feed have not been observed to contain any anisakid worms compared to wild salmon. Closed systems with controlled feed and environment conditions can effectively eliminate parasites that normally occur in wild fish.

3.2 HYGIENIC PRODUCTION OF FOOD SOURCES

45. Refer to Section 3 and Section 6 of the *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003), and the *Code of Practice on Good Animal Feeding* (CAC/RCP 54-2004) and the relevant Chapters of the *OIE Aquatic Animal Health Code*[9] the *FAO Technical Paper on Assessment and Management of Fish Safety and Quality-Current Practices and Emerging Issues* [10].

46. To prevent potential transmissions of parasites, fingerlings should only be purchased from producers who implement reliable source management systems and Good Aquaculture Practice (GAqP). Fingerlings collected from the wild may contain foodborne parasites that remain a hazard in adult fish.

47. Animals and people infected with foodborne parasites may excrete parasite eggs that enter water and develop into larval stages that subsequently infect farmed fish. In order to minimize the opportunity for contamination of the production environment with parasitic stages from human faeces, on-farm sanitary facilities should be installed, e.g. functional latrines, and an adequate means of hygienically washing and drying hands.

48. Animals, including dogs and cats, are hosts for freshwater trematode fishborne parasites and should be excluded from land-based fish ponds to the extent possible. Good practices include not feeding raw meat/offal of fish to dogs and cats, preventing fish-eating mammals from accessing fish ponds and controlling the population of semi-domesticated or stray/feral dogs and cats in close vicinity of fish farms. Workers infected with or being treated for fish-borne trematodes (liver and intestinal flukes) should be excluded from the farm environment during treatment.

49. Attention should also be given to animals that serve as intermediate hosts[11] in the life cycle of fishborne parasites. For example, in the case of aquaculture, the exclusion of snails, as intermediate hosts for fishborne trematodes, from fish farm areas, may help interrupt trematode life cycles in fish ponds. For wild fish, intermediate hosts cannot be controlled, and fish migrate from different areas with varying risks for exposure to parasites.

50. Using raw fish as feed for aquaculture is likely to introduce a risk of parasitic infection, therefore it should be avoided as much as possible. Raw fish used for feed may be previously frozen in order to inactivate parasites. It is particularly important to inactivate parasites in feed where the fish will not be subsequently frozen, and may be consumed raw or undercooked.

51. Toilets should not directly empty into land-based fish ponds. Fishponds should be protected from contamination from human and animal faeces, pollution with sewage and other wastes. Untreated human and animal excreta should not be used as fertilizer or as fish food.

52. Where needed, control measures at primary production should be assessed in order to determine if they are properly implemented and effective. Fish surveillance may be a useful tool for assessing control measure needs/shortcomings; however, because of the practical limitations of sampling and testing methodology, testing cannot assure the absence of a parasite hazard.

3.3 HANDLING, STORAGE AND TRANSPORT

53. Eviscerating fish without any undue delay during harvest is helpful to prevent migration of Anisakidae larvae from the viscera into the flesh after harvest.

54. Refer to Sections 6.3.5 and 6.3.6 of the *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003), and the relevant Chapters of the *OIE Aquatic Animal Health Code* for considerations for transport.

3.4 CLEANING, MAINTENANCE AND PERSONNEL HYGIENE AT PRIMARY PRODUCTION

55. Refer to Sections 3.4 and 3.5 of the *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003) and the relevant Chapters of the *OIE Aquatic Animal Health Code*.

3.5 MONITORING AND SURVEILLANCE AT PRIMARY PRODUCTION

56. Examining fish for live fishborne parasites may be a useful tool to assess the effectiveness of fishborne parasite preventive control measures. Data from monitoring and surveillance can be useful to develop and review risk management strategies.

57. Assurance that a parasite hazard is adequately controlled may be attained through demonstration of properly implemented controls and hygienic practices, which may be supported by a series of negative test results over a sufficient time period through a risk-based surveillance programme.

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[9] http://www.oie.int/international-standard-setting/aquatic-code/access-online/
[10] http://www.fao.org/3/a-i3215e.pdf
[11] A host which harbours the larval developmental stages of the parasite prior to maturity

D. Fresh fruits and vegetables

58. Important fruit- and vegetable-transmitted foodborne parasites include, but are not limited to, *Taenia solium*, *Echinococcus granulosus*, *Echinococcus multilocularis*, *Toxoplasma gondii, Entamoeba histolytica, Cryptosporidium* spp., *Ascaris* spp*., Giardia duodenalis*, *Fasciola* spp., *Cyclospora cayetanensis*, *Trichuris trichiura*, *Balantidium coli*, and *Toxocara* spp. For information on specific food vehicles for these parasites see Table 2 in FAO/WHO report on *Multicriteria-Based Ranking for Risk Management of Food-Borne Parasites*2.

59. Certain fruits and vegetables are consumed raw without a cooking or freezing step or disinfection to kill parasites. In this case, controls that reduce the parasite hazard to an acceptable level during primary production are especially important.

3.1 ENVIRONMENTAL HYGIENE

60. Refer to Section 3.1 of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003).

61. Areas for cultivation of fresh fruits and vegetables need to be assessed in terms of their susceptibility to direct or indirect faecal contamination from wild animals, domestic animals and/or humans, whether from run-off, flooding, irrigation water, or natural fertilizers. Prior to selecting the site for cultivation it should be determined if adequate control measures can be implemented to manage any identified risks.

3.2 HYGIENIC PRODUCTION OF FOOD SOURCES

62. Refer to the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003) and the *WHO/OIE Manual on Echinococcus in Human and Animals*[12].

63. The use of biological soil amendments of animal origin, particularly on fresh produce, should be managed to minimize the potential for contamination with parasites (e.g. adequately treating manure). Parasite eggs and oocysts can survive for years in the environment, and can be highly resistant to environmental changes; for example *Ascaris* eggs can remain viable in anaerobically digested sewage sludge.

64. In case the presence of infected snail intermediate host (Lymnaeidae) is identified, aquatic plants, such as watercress, grown in the area should not be harvested for raw consumption in order to prevent infection with *Fasciola hepatica and F. gigantica*.

65. Flooding may cause contamination of crops with water containing the parasite eggs, cysts and oocysts from animal or human faeces. After such events, produce should be evaluated for risk of contamination and where there is a risk, proper disposal of the affected produce is needed.

3.4 CLEANING, MAINTENANCE AND PERSONNEL HYGIENE AT PRIMARY PRODUCTION

66. Refer to Sections 3.2.3 and 3.4 of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003).

SECTION 4 - ESTABLISHMENT: DESIGN AND FACILITIES

4.2 PREMISES AND ROOMS

4.2.1 Design and layout

67. The post-harvest processing establishment should be designed to exclude animals that may excrete faeces that contain parasite stages. The layout should minimize the introduction of soil that may contain faeces from animals and parasite stages from the outside environment. (e.g. changing boots/clothes at the entrance of the establishment).

[12] http://whqlibdoc.who.int/publications/2001/929044522X.pdf

SECTION 5 - CONTROL OF OPERATION

5.1 CONTROL OF FOOD HAZARDS

68. Control measures are used to address specific foodborne parasite hazards, e.g. as part of a Hazard Analysis and Critical Control Point (HACCP)-based system. Contamination of foods during processing with parasites transmitted by the faecal-oral route is typically controlled by a stringent application of hygiene control systems, which could be referred to as, e.g. Good Hygienic Practices (GHPs) and sanitation standard operation procedures (SSOPs). These prerequisite programs, together with validated interventions for specific parasites provide a framework for the control of foodborne parasites.

69. During the parasite hazard analysis, food business operators should consider how the product will be further processed, prepared and consumed in order to determine appropriate parasite controls. Where the hazard analysis indicates the presence of a significant foodborne parasite hazard, slaughter and post-harvest processing operations should have control measures in place that prevent or eliminate the hazard or reduce it to an acceptable level.

70. The hazard analysis may determine that a foodborne parasite hazard is adequately controlled at primary production, or by the previous processor. In this case, methods may be used to verify that previous control measures are adequate, such as inspecting the implementation of control measures at the primary producer or previous processor, and for some products, testing incoming product for the presence of parasites.

71. Various processes have been shown to control parasites in selected food items, but the conditions needed to inactivate parasites are subject to substantial variability depending on the parasites, the food matrix and the location of parasites in the food matrix. Specific processing steps and processing combinations should be subject to rigorous validation to ensure consumer protection. For additional information on validation, refer to the *Guidelines for the Validation of Food Safety Control Measures* (CAC/GL69-2008). Control measures may include: freezing, heat treatment, salting, drying, high pressure processing, filtration, sedimentation, UV light, ozone and irradiation. Specific processing steps and processing combinations (hurdle concept) to control parasites should be used in accordance with guidance from competent authorities, where available.

5.2 KEY ASPECTS OF HYGIENE CONTROL SYSTEMS

5.2.1 Time and temperature control

72. Time and temperature control treatments (freezing and heating) that will result in the reduction/elimination of viable parasites are the most commonly used preventative control measures. Such treatments should be done in accordance with validated parameters, as described in relevant and reliable guidelines and other scientific literature.

5.2.2 Specific process steps

5.2.2.1 Freezing

73. Many parasites in food are susceptible to freezing. However, specific time/temperature combinations are required to inactivate parasites by freezing, and these are also dependent on the food type and portion size. Some parasites (e.g.*Trichinella nativa* and *T. britovi* larvae or eggs of *Echinococcus multilocularis*) are resistant to freezing.

74. For control of parasites in fish and fishery products intended for raw consumption by freezing, refer to Annex 1 of the *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003). For control of parasites in cold smoked fish, smoke-flavoured fish, and smoke-dried fish refer to Annex 1 of the *Standard for Smoked Fish, Smoke-flavoured Fish and Smoke-dried Fish* (CODEX STAN 311-2013).

5.2.2.2 Heat treatment

75. Parasites can be inactivated by adequate heat treatment of foods and water. Other validated treatments may be used.

5.2.2.3 Salting, curing, marinating, pickling, smoking

76. Processing methods such as salting, curing, marinating, pickling, smoking, and addition of food additives that may be effective for the control of certain other foodborne pathogens are generally not sufficient for the control of foodborne parasites. Combinations of several treatments (hurdle concept) can be effective to control parasites. When a combination of treatments is used, it should be subject to rigorous validation to ensure consumer protection.

5.2.2.4 Irradiation

77. Irradiation is a possible measure for parasite control. Refer to the *General Standard for Irradiated Foods* (CODEX STAN 106-1983).

5.2.2.5 Washing

78. Fruits and vegetables should be washed with water in accordance with the Section 5.2.2.1 of the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003) to reduce parasites. However, it should be noted that most parasite eggs or oocysts are sticky and difficult to remove from fruits and vegetables, particularly those with crevices or folds on the surface.

5.4 PACKAGING

79. It should be noted that vacuum packaging does not alter the infectivity of parasites in food.

5.7 DOCUMENTATION AND RECORDS

80. Documentation related to validation, monitoring and verification activities regarding the control measures used for parasites should be kept.

81. Monitoring and review of foodborne parasite safety control systems is an essential component of application of a risk management framework (RMF). It contributes to verification of process control and demonstrating progress towards achievement of public health goals.

82. Information on the level of control of parasites at appropriate points in the food chain can be used for several purposes e.g. to validate and/or verify outcomes of food control measures, to monitor compliance with public health goals, and to help prioritise regulatory efforts to reduce foodborne parasite illnesses.

SECTION 6 – ESTABLISHMENT: MAINTENANCE AND SANITATION

6.3 PEST CONTROL SYSTEMS

83. Insects, such as flies and cockroaches, and animals such as rodents and birds can transport parasite stages from faeces to food and should be controlled.

SECTION 7 – ESTABLISHMENT: PERSONAL HYGIENE

84. Proper personal hygiene such as hand-washing practices should be used to prevent faecal-oral transmission of parasites. For example, workers infected with the tapeworm *T. solium* with improper hand-washing practices can spread eggs that result in the severe disease neurocysticercosis.

SECTION 9 – PRODUCT INFORMATION AND CONSUMER AWARENESS

9.2 PRODUCT INFORMATION

85. Labels may be used to help differentiate between products that are intended for raw consumption and products that are intended to be cooked by the consumer. However, even with the beneficial use of labels instructing consumers to cook the product, a parasite hazard should be reduced to an acceptable level before marketing products that are likely to be consumed raw or undercooked.

9.4 CONSUMER EDUCATION

86. In order to increase consumer awareness of foodborne parasite hazards, education, is an important component of risk management, and in some cases may be the only practical option available. Consumers should recognize the risks associated with consumption of raw, undercooked, and lightly processed (e.g. marinated, smoked) meat and fish, as well as the consumption of certain fruits and vegetables that may not be rendered safe simply by washing alone. Consumer advice should be provided on how to prepare foods (e.g. cooking times and temperatures) and on the importance of good hygiene (e.g. hand-washing) in order to avoid infection with foodborne parasites. Consumers should always make sure to separate raw foods from cooked food, and ready to eat fruit and vegetables to prevent cross-contamination while handling and preparing meals. The WHO Five Keys to Safer Food could assist in this process.[13]

[13] WHO. 2006. Five Keys to Safer Food Manual. Available at: /http://www.who.int/foodsafety/publications/5keysmanual/en/

87. Education is particularly important for consumers in endemic areas, and in high risk groups, such as those who are pregnant or immunocompromised (e.g. *Toxoplasma gondii* in pregnant women and immunocompromised groups; *Cryptosporidium* spp. in children, immunocompromised groups and older adults.) For such consumers, advice on the preparation and consumption of high-risk foods such as fresh produce, adequate cooking of meat and fish prior to consumption and the importance of hygiene, e.g. hand-washing, is critical. When people are diagnosed with an *Anisakis* spp. nematodes allergy, they should be advised to avoid eating marine fish.

SECTION 10 – TRAINING

88. Workers engaged in primary production, processing, preparation, retail or food service should be trained and/or instructed in the control of foodborne parasites (e.g. from good animal husbandry practices to hygiene and sanitation measures) to a level appropriate to the operations they are to perform. Particular attention should be paid to abattoir workers who may be performing post-mortem inspection procedures and food handlers of ready-to-eat foods.

10.2 TRAINING PROGRAMMES

89. Training programmes should contain information on the following, as appropriate to those being trained:

- The potential for food to be a vehicle of transmission of foodborne parasites if contaminated.
- The potential sources and routes of transmission of foodborne parasites.
- The potential for persistence of parasites in/on contaminated foods and food production settings.
- The need to comply with good animal husbandry practices and the importance of compliance with such practices, including:
  - the role of domestic and wild animals in the transmission of certain parasites;
  - the importance of on-farm sanitation and hygiene in interrupting the life cycle of parasites and minimizing the opportunity for faecal-oral transmission; and
  - the importance of animal feed management to avoid domestic and wild life parasite contamination.
- Proper hand washing practices and the importance of strict compliance with hand washing instructions at all times, particularly after being in contact with faecal matter. It is advisable to educate each new employee in the proper practices that are to be followed for hand-washing.
- The importance of adequate food processing and preparation to eliminate potential parasite risks.
- Task-specific practices to reduce or eliminate the risks of parasites in foods.

10.3 INSTRUCTION AND SUPERVISION

90. Training and instructions should be given to all new personnel on the transmission and management of foodborne parasites.

91. Inspectors or other relevant authorities, who inspect fields, post-harvest processing plants, and food service facilities, should also be trained.

92. Periodic retraining of existing personnel should be given as refresher and to maintain competence level of all personnel.

Appendix IV

PROPOSED DRAFT ANNEXES TO THE *CODE OF HYGIENIC PRACTICE FOR LOW MOISTURE FOODS*

ANNEX I

(N06-2013)

(at Step 5/8)

EXAMPLES OF MICROBIOLOGICAL CRITERIA FOR LOW-MOISTURE FOODS WHEN DEEMED APPROPRIATE IN ACCORDANCE WITH THE *PRINCIPLES AND GUIDELINES FOR THE ESTABLISHMENT AND APPLICATION OF MICROBIOLOGICAL CRITERIA RELATED TO FOODS* (CAC/GL 21-1997)

1. While the safety of foods is principally achieved through the implementation of control measures, microbiological testing can be a useful tool to evaluate and verify the effectiveness of food safety and food hygiene practices, provide information about process control, and even a specific product lot, when sampling plans and methodology are properly designed and performed. The intended use of information obtained (e.g. evaluating the effectiveness of process hygiene, evaluating the risk posed by a particular hazard) can aid in determining what microorganisms are most appropriate to test for. Test methods validated for the intended use should be selected. Consideration should be given to ensure proper design of a microbiological testing program. Trend analysis of testing data should be undertaken to evaluate the effectiveness of food safety control systems.

2. Refer to the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997).

3. Where appropriate, specifications for pathogenic microorganisms, such as *Salmonella* spp., should be established that take into account subsequent processing steps, the end use of the low moisture food, the conditions under which the product was produced, as well as the intended population, especially when such a population may be more susceptible to foodborne infection.

4. When used properly and combined with validated process controls, testing can provide actionable information that helps to assure the safety of the products produced. Testing cannot guarantee the safety of the product. Microbiological testing alone is limited in its application and may convey a false sense of confidence in the safety of the food due to the statistical limitations of sampling plans, particularly when the hazard presents an unacceptable risk at low concentrations and has a low and variable prevalence. Microorganisms are not homogeneously distributed throughout food and testing may fail to detect organisms present in a lot.

Example of microbiological criteria for low-moisture food products

5. Low-moisture foods include many different types of products. Microbiological testing is not appropriate for all low-moisture food products. Therefore, conditions under which food is expected to be handled, treated, and consumed after sampling should be considered when establishing a microbiological criterion. For example, a microbiological criterion is not needed for a low-moisture food that will undergo wet blending and a heat treatment that will eliminate *Salmonella*. The *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997) should be followed in determining whether a microbiological criterion for *Salmonella* would be deemed necessary and would contribute to the protection of public health.

6. The following microbiological criteria can be used for a low-moisture food when deemed necessary for verification of *Salmonella* control. The criteria are based on whether the potential for the risk decreases (e.g. cooking reduces the number of *Salmonella*), remains the same (the number of *Salmonella* changes very little), or increases (e.g. potential growth, such as use of the low-moisture food as an ingredient in a high moisture food) between the time of sampling and when the food is consumed or when the food targets a population that is highly susceptible to foodborne infection (e.g. the young, the elderly, and the immuno compromised). The sampling plan may be adjusted based on product specific data, e.g., a history of data indicating a process is operating consistently. Ongoing process control verification testing, which can use a "moving window approach" can also reduce the amount of testing. Finally, the need for testing can be minimized when product safety is addressed by raw material controls and by the design and implementation of process controls, with ongoing documentation demonstrating that the appropriate procedures have been followed.

Example Microbiological Criteria that May be Appropriate for Low-Moisture Foods If Such Criteria are Deemed Necessary[g,h]					
Microorganism/Target population	**Likely change to level of hazard/risk**	**n**	**c**	**m**	**Class Plan**
Salmonella/ Intended for consumption by general population	Reduce risk[a]	5	0	0/25 g	2
	No change in risk[b]	10	0	0/25 g	2
	May increase risk[c]	20	0	0/25 g	2
Salmonella/ Intended for consumption by highly susceptible populations	Reduce risk[d]	15	0	0/25 g	2
	No change in risk[e]	30	0	0/25 g	2
	May increase risk[f]	60	0	0/25 g	2

Where n = number of samples that must conform to the criterion; c = the maximum allowable number of defective sample units in a 2-class sampling plan; m = a microbiological limit which, in a 2-class plan, separates good quality from defective quality.

[a] The sampling plan performance is the geometric mean concentration (grams containing one cell) at which the sampling plan will reject a lot with 95% confidence. The geometric mean concentration detected is 1 cfu in 49 g of product if the within lot standard deviation is assumed to be 0.5 log cfu/g. The geometric mean concentration detected is 1 cfu in 55 g of product if the within lot standard deviation is assumed to be 0.8 log cfu/g. [1]

[b] The sampling plan performance is the geometric mean concentration (grams containing one cell) at which the sampling plan will reject a lot with 95% confidence. The geometric mean concentration detected is 1 cfu in 120 g of product if the within lot standard deviation is assumed to be 0.5 log cfu/g. The geometric mean concentration detected is 1 cfu in 180 g of product if the within lot standard deviation is assumed to be 0.8 log cfu/g.[1]

[c] The sampling plan performance is the geometric mean concentration (grams containing one cell) at which the sampling plan will reject a lot with 95% confidence. The geometric mean concentration detected is 1 cfu in 270 g of product if the within lot standard deviation is assumed to be 0.5 log cfu/g. The geometric mean concentration detected is 1 cfu in 490 g of product if the within lot standard deviation is assumed to be 0.8 log cfu/g.[1]

[d] The sampling plan performance is the geometric mean concentration (grams containing one cell) at which the sampling plan will reject a lot with 95% confidence. The geometric mean concentration detected is 1 cfu in 200 g of product if the within lot standard deviation is assumed to be 0.5 log cfu/g. The geometric mean concentration detected is 1 cfu in 330 g of product if the within lot standard deviation is assumed to be 0.8 log cfu/g.1

[e] The sampling plan performance is the geometric mean concentration (grams containing one cell) at which the sampling plan will reject a lot with 95% confidence. The geometric mean concentration detected is 1 cfu in 430g of product if the within lot standard deviation is assumed to be 0.5 log cfu/g. The geometric mean concentration detected is 1 cfu in 850g of product if the within lot standard deviation is assumed to be 0.8 log cfu/g.[1]

[f] The sampling plan performance is the geometric mean concentration (grams containing one cell) at which the sampling plan will reject a lot with 95% confidence. The geometric mean concentration detected is 1 cfu in 910 g of product if the within lot standard deviation is assumed to be 0.5 log cfu/g. The geometric mean concentration detected is 1 cfu in 2000 g of product if the within lot standard deviation is assumed to be 0.8 log cfu/g.[1]

[g] The methods to be employed should be the most recent version of ISO 6579, or other validated methods that provide equivalent sensitivity, reproducibility, and reliability.

[h] The criterion above is applied with the underlying assumption that the history of the lot is unknown, and the criterion is being used on a lot-by-lot basis. In those instances where the history of the product is known (e.g. the product is produced under a fully documented HACCP system), alternate sampling criteria involving between-lot process control testing may be feasible (e.g. the “moving window” approach). The typical action to be taken when there is a failure to meet the above criterion would be to (1) prevent the affected lot from being released for human consumption; (2) recall the product if it has been released for human consumption and (3) determine and correct the root cause of the failure.

[1] FAO/WHO.2016. Risk Manager’s Guide to the Statistical Aspects of Microbiological Criteria Related to Foods Microbiological Risk Assessment Series VOL 24, available at ftp://ftp.fao.org/codex/meetings/CCFH/CCFH46/FAO%20MC%20draft%20140814a.pdf

ANNEX II

(N06-2013)

(at Step 5/8)

GUIDANCE FOR THE ESTABLISHMENT OF ENVIRONMENTAL MONITORING PROGRAMMES FOR *SALMONELLA* SPP. AND OTHER ENTEROBACTERIACEAE IN LOW-MOISTURE FOOD PROCESSING AREAS

1. Manufacturers of low-moisture foods should consider the potential risk to consumers in the event their products contain *Salmonella* when they are released for distribution. Environmental monitoring in low-moisture food processing environments is a useful means of verifying effectiveness of hygiene controls applied and of detecting potential harbourage sites for pathogens. It also generates information about the processing environment, allowing corrective actions to be taken in a timely manner.

2. Environmental monitoring should be conducted under normal operating conditions. The appropriate sampling approach should depend on the purpose of sampling (i.e. what is to be verified) and the significance of the environment in terms of the likelihood of contaminating end products. Examples of areas where environmental monitoring should be used include post-lethality areas, packing lines and other areas immediately surrounding where ready-to-eat foods are exposed to the environment.

3. Environmental monitoring sampling sites should be prioritized according to the likelihood of contamination of processing lines and the impact on product in case of contamination.

4. The sampling approach may be adjusted according to the previous findings and, where appropriate, should include sampling from additional locations and/or from finished product, as part of corrective actions for non-conforming environmental results. Sampling plans should also be modified appropriately when facility and equipment modifications occur.

5. A number of factors (a - g) should be considered when developing the sampling program to ensure its effectiveness:

(a) Target organisms

i. Most microorganisms present in the processing environment are transient and are eliminated by the cleaning procedures in place. However, some may find a harbourage site within the environment unless appropriate care is taken to prevent this.

ii. *Salmonella* can survive desiccation for long periods of time and can persist in the dry environment of low-moisture food establishments. Therefore, where end products may be contaminated with *Salmonella* from the environment, as a minimum, environmental monitoring should be targeted at *Salmonella*. As *Salmonella* may occur in low numbers, environmental monitoring is often combined with monitoring of the family Enterobacteriaceae (EB), which includes *Salmonella*, as this group shows similar resistance to drying and is more common in processing facilities. Consequently, the monitoring of EB in the environment may provide an early indication that the conditions necessary for *Salmonella* colonisation may exist, and hence provide an earlier indication of potential problems. Testing of EB can also be used to verify the effectiveness of cleaning procedures.

(b) Sampling locations, number of samples and timing

i. The number of samples will vary with the complexity of the process and processing lines and the intended use of the food (e.g. ready-to-eat foods vs. ingredients for further processing).

ii. Preferential locations for sampling should focus on areas where harbourage or entry leading to contamination is likely to occur, especially difficult to access sites, and where product is exposed to the environment. Greater emphasis should be placed on sampling areas after a pathogen reduction step, if one is used for the food. Information on appropriate locations can be found in the published literature and should be based on process experience and expertise, or on historical data gathered through plant surveys. Sampling locations should be reviewed on a regular basis and additional ones may need to be included in the program, depending on special situations such as major maintenance or construction activities or where there is observed indication of poor hygiene.

iii. It is important to conduct environmental sampling, particularly for *Salmonella*, after several hours of production in order to detect microorganisms transferred from harbourage sites. There should be adequate sampling of all manufacturing shifts and production periods within these shifts. Additional samples for EB testing just prior to start-up are good indices of the effectiveness of cleaning operations.

(c) Frequency of sampling

i. The frequency of environmental sampling should be based primarily on factors such as the characteristics of the products and of the area sampled, and the amount of production. It should be defined based on existing data on the presence of relevant microorganisms in the areas submitted to such a monitoring program. In the absence of such information, sufficient suitable data should be generated to correctly define the appropriate frequency. Such data should be collected over sufficiently long periods of time so as to provide representative and reliable information on the prevalence and occurrence of *Salmonella*.

ii. The frequency of the environmental sampling should be adjusted according to the findings and their significance in terms of the risk of contamination. In particular, the detection of pathogens in the finished product should lead to increased environmental and investigational sampling to identify the contamination sources. The frequency should also be increased in situations where an increased risk of contamination can be expected, e.g. in the case of maintenance or construction activities, a contamination event, or following wet cleaning activities.

(d) Sampling tools and techniques

It is important to choose and adapt the type of sampling tools and techniques to the type of surface and sampling locations. For example, scraping of residues from surfaces or collection of residues from vacuum cleaners may provide useful samples, and moistened sponges may be appropriate for large surfaces. Sampling tools and techniques may need to be validated to demonstrate effective recovery of the target organisms. In areas requiring stringent hygiene controls, wipes and sponges should be slightly moistened (not wet or dripping) to collect as much residue as possible. After sampling, care should be taken to ensure the area is completely dry after the sampling.

(e) Analytical methods

The analytical methods used to analyse environmental samples should be suitable for the detection of the target organisms. Special focus should be paid to the characteristics of food matrices in order to adapt the preparation of food samples where food residues are tested. Considering the characteristics of environmental samples, it is important to demonstrate that the methods are able to detect, with acceptable sensitivity, the target organisms. This should be documented appropriately. Under certain circumstances, it may be possible to composite (pool) certain samples but if this is done then the sensitivity of the microbiological testing method should not be reduced. However, in the case of positive findings, additional testing will be necessary to determine the location of the positive sample.

(f) Data management

The monitoring program should include a system to record the data and to facilitate their evaluation, e.g. performing trend analyses. A continual review of the data is important to revise and adjust monitoring programs and take actions to manage contamination.

(g) Actions in case of non-conforming results

i. The purpose of the monitoring program is to find target organisms, if present in the environment. Decision criteria and responses based on these monitoring programs should be articulated when establishing the program. The plan should define the specific action to be taken and the rationale. This could range from no action (no risk of contamination), to intensified cleaning, to source tracing (increased frequency and number of samples for environmental testing), to review of hygienic practices, holding and testing of product, up to product disposition. In the case of persistent contamination, the identification of the strain (e.g. molecular subtyping) could be helpful for taking appropriate corrective actions.

ii. In general, manufacturers should expect to find EB in the processing environment. Therefore, an appropriate action plan should be designed and established to adequately respond where decision criteria are exceeded. Decision criteria can be based upon individual results as well as on trends. A review of hygiene procedures and controls should be considered when criteria are exceeded. The manufacturer should address each non-conforming result of *Salmonella* and evaluate changes and/or patterns in the trends of EB counts; the type of action will depend upon the likelihood of contaminating the product with *Salmonella* and/or other pathogens of concern.

ANNEX III

(for adoption)

ANNEX ON SPICES AND DRIED AROMATIC HERBS

INTRODUCTION

1. Dried, fragrant, aromatic or pungent, edible plant substances, in the whole, broken or ground form, e.g. spices and dried aromatic herbs, impart flavour, aroma or colour when added to food. Spices and dried aromatic herbs may include many parts of the plant, such as aril, bark, berries, buds, bulbs, leaves, rhizomes, roots, seeds, stigmas, pods, resins, fruits, or plant tops.

2. The production, processing, and packing of spices and dried aromatic herbs are very complex. For example, source plants for spices and dried aromatic herbs are grown in a wide range of countries and on many types of farms, e.g. from very small farms to, in rare instances, large farms. Agricultural practices for growing source plants for spices and dried aromatic herbs also vary tremendously from virtually no mechanization to highly mechanized practices. Drying of source plants may be performed mechanically (for rapid drying) or naturally (e.g. slower drying under the sun for several days). The distribution and processing chain for spices and dried aromatic herbs is also highly complex and can span long periods of time and include a wide range of establishments. For example, spices and dried aromatic herbs grown on small farms may pass through multiple stages of collection and consolidation before reaching a spice processor and packer or a food manufacturer. Dried product processing generally involves cleaning (e.g. culling, sorting to remove debris), grading, sometimes soaking, slicing, drying, and on occasion grinding/cracking. Some spices and dried aromatic herbs are also treated to mitigate microbial contamination, typically by steam treatment, gas treatment (e.g. ethylene oxide), or irradiation. Processing and packing/repacking may also take place in multiple locations over long periods of time, since spices and dried aromatic herbs are prepared for different purposes.

3. The safety of spices and dried aromatic herbs products depends on maintaining good hygienic practices along the food chain during primary production, processing, packing, retail, and at the point of consumption. Sporeforming bacteria, including pathogens such as *Bacillus cereus*, *Clostridium perfringens*, and *Clostridium botulinum*, as well as non-sporeforming vegetative cells of microorganisms such as *Escherichia coli, Staphylococcus aureus*, and *Salmonella* spp. have been found in spices and dried aromatic herbs. There have been a number of outbreaks of illness associated with spice and seasoning consumption, with most being caused by *Salmonella* spp. that have raised concerns regarding the safety of spices and dried aromatic herbs. The complex supply chain for spices and dried aromatic herbs makes it difficult to identify the points in the food chain where contamination occurs, but evidence has demonstrated that contamination can occur throughout the food chain if proper practices are not followed.

4. The safety of spices and dried aromatic herbs can also be affected by mycotoxin-producing moulds, e.g. those producing aflatoxin (such as *Aspergillus flavus* or *Aspergillus parasiticus*) or ochratoxin A (such as *Aspergillus ochraceus, Aspergillus carbonarius,* or *Penicillium verrucosum*). Chemical hazards such as heavy metals and pesticides, as well as physical contaminants such as stones, glass, wire, extraneous matter and other objectionable material, may also be present in spices and dried aromatic herbs.

SECTION I - OBJECTIVES

5. This Annex addresses Good Agricultural Practices (GAPs), Good Manufacturing Practices (GMPs) and Good Hygienic Practices (GHPs) that will help minimize contamination, including microbial, chemical and physical hazards, associated with all stages of the production of spices and dried aromatic herbs from primary production to consumer use. Particular attention is given to minimizing microbial hazards.

SECTION II - SCOPE, USE AND DEFINITION

2.1 SCOPE

6. This Annex applies to spices and dried aromatic herbs - whole, broken, ground or blended. Spices and dried aromatic herbs may include the dried aril (e.g. the mace of nutmeg), bark (e.g. cinnamon), berries (e.g. black pepper), buds (e.g. clove), bulbs (e.g. dried garlic), leaves (e.g. dried basil), rhizomes (e.g. ginger, turmeric), seeds (e.g. mustard), stigmas (e.g. saffron), pods (e.g. vanilla), resins (e.g. asafoetida), fruits (e.g. dried chilli) or plant tops (e.g. dried chives). It covers the minimum requirements of hygiene for growing, harvesting and post-harvest practices (e.g. curing, bleaching, blanching, cutting, drying, cleaning, grading, packing, transportation and storage, including disinfestation and fumigation) processing establishment, processing technology and practices (e.g. grinding, blending, freezing and freeze-drying, treatments to reduce the microbial load) packaging and storage of processed products. For spices and aromatic herbs

collected from the wild, only the measures for handling and post-harvest activities (i.e. from section 3.3.2 onward) apply.

2.2 USE

7. This Annex follows the format of the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and should be used in conjunction with it and other applicable codes such as the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003) and the *General Standard for Contaminants and Toxins in Food and Feed* (CODEX STAN 193-1995).

8. This Annex is a recommendation to which producers in different countries should adhere as far as possible taking into account the local conditions while ensuring the safety of their products in all circumstances. Flexibility in the application of certain requirements of the primary production of spices and dried aromatic herbs can be exercised, where necessary, provided that the product will be subjected to control measures sufficient to obtain a safe product.

2.3 DEFINITIONS

9. Refer to definitions in the *General Principles of Food Hygiene* (CAC/RCP 1–1969) and the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003). In addition, the following expressions have the meaning stated:

Spices and Dried Aromatic Herbs – dried plants or parts of plants (roots, rhizomes, bulbs, leaves, bark, flowers, fruits, and seeds) used in foods for flavouring, colouring, and imparting aroma. This term equally applies to whole, broken, ground and blended forms.

Disinfest – to eliminate harmful, threatening, or obnoxious pests, e.g. vermin

Microbial Reduction Treatment – process applied to spices and dried aromatic herbs to eliminate or reduce microbial contaminants to an acceptable level.

Source Plant –plant (non-dried) from which the spice or dried aromatic herb is derived.

SECTION III - PRIMARY PRODUCTION

3.1 ENVIRONMENTAL HYGIENE

10. Source plants for spices and dried aromatic herbs should be protected, to the extent practicable, from contamination by human, animal, domestic, industrial and agricultural wastes which may be present at levels likely to be a risk to health.

3.3 Handling, STORAGE AND TRANSPORT

11. Each source plant should be harvested using a method suitable for the plant part to be harvested in order to minimize damage and the introduction of contaminants. Plant matter that is damaged or other plant waste material should be disposed of properly and removed from the growing/harvest area in order to minimize the potential for it to serve as a source of mycotoxin-producing moulds or pathogenic bacteria. If possible, only the amount that can be processed in a timely manner should be picked in order to minimize growth of mycotoxin-producing moulds and pathogenic bacteria prior to processing. When the amount harvested exceeds processing capabilities, the excess should be stored under appropriate conditions.

3.3.1 Prevention of cross-contamination

12. Specific control methods should be implemented to minimize the risk of cross-contamination from microorganisms associated with harvesting methods. The following should be considered:

- Where appropriate, the soil under the plant should be covered with a clean sheet of plastic or clean plant material such as straw during picking/harvesting to avoid contamination by dirt or plant matter that has fallen prior to harvesting. Plastic that will be reused should be easy to clean and disinfected. Plant material should be used only once.
- Source plant material that has fallen to the ground should be disposed of properly if it cannot be made safe by further processing.

3.3.2 Storage and transport from the growing/harvest area to the packing establishment

13. Spices and dried aromatic herbs should be kept in areas where contact with water or moisture is minimized.

14. Spices and dried aromatic herbs should be stored on raised platforms or hung under a non-leaking roof in a cool dry place. The storage location should prevent access, to the extent practicable, by rodents or other animals and birds and should be isolated from areas of excessive human or equipment traffic.

3.3.3 Drying

3.3.3.1 Natural Drying

15. Refer to the *Code of Practice for the Reduction of Contamination of Food with Polycyclic Aromatic Hydrocarbons (PAH) from Smoking and Direct Drying Processes* (CAC/RCP 68-2009) with regard to the location of the drying area.

16. Plants or parts of plants used for the preparation of spices and dried aromatic herbs may be dried naturally, e.g. air dried, provided adequate measures are taken to prevent contamination of the raw material during the process. The drying time depends on the environmental conditions surrounding the product, i.e. temperature, relative humidity, and air velocity.

17. If dried naturally, plants or parts of plants should be dried on clean, elevated racks, clean concrete floors, or clean mats or tarps or by hanging under a non-leaking roof and not on the bare ground or in direct contact with the soil. Pathways should be made in the drying area to prevent anyone from walking on the crop. The drying plant material should be raked/turned frequently to limit mould growth.

18. Concrete floors or slabs poured specifically for drying source plants should be subject to an appropriate cleaning program and, where appropriate, disinfected. New concrete slabs should be used for drying only when it is absolutely certain that the new concrete is well-cured and free of excess water. A suitable plastic cover spread over the entire new concrete slabs can be used as a moisture barrier; however, the sheet should be completely flat to prevent the pooling of water. Suitable precautions should be taken, where practicable, to protect the spices and dried aromatic herbs from contamination and damage by domestic animals, rodents, birds, mites, insects or other objectionable substances during drying, handling and storage. If drying outdoors, drying platforms should be placed under a roof/tarp free of tears, holes or frayed material that will prevent rewetting by rainfall and contamination from birds overhead.

19. Drying time should be reduced as much as possible by using optimal drying conditions (e.g. temperature, humidity and ventilation) to avoid fungal growth and toxin production. The thickness layer of the drying source plant material should be considered in order to consistently achieve a safe moisture level.

3.3.3.2 Mechanical Drying (see Section 5.2.1.1)

3.3.4 Packing in the growing/harvest area

20. Packing activities can occur in the growing/harvest area. Such packing operations should include the same sanitary practices, where practical, as packing spices and dried aromatic herbs in establishments or modified as needed to minimize risks. To prevent germination and growth of spores, the products must be dried to a safe moisture level prior to packing.

21. When packing spices and dried aromatic herbs in the growing/harvest area for transport, storage, or for further sale, new bags/containers should be used to prevent the potential for microbial, physical and chemical contamination. When bags/containers are marked, food-grade ink should be used to minimize the potential for contamination with ink. When bags/containers have an open structure, such as jute bags, the bag/container should not be marked when filled with spices and dried aromatic herbs to prevent liquid ink from contaminating the contents and increasing the moisture in the spices and dried aromatic herbs. It is recommended that paper tags be used instead of liquid ink for marking.

22. Removal of discarded plant material should be done on a regular basis in order to avoid accumulation that would promote the presence of pests.

SECTION IV - ESTABLISHMENT: DESIGN AND FACILITIES

4.2 PREMISES AND ROOMS

23. Where practicable, buildings and facilities should be designed to provide separation, by partition, location or other effective means, between operations that could result in cross-contamination. They should be designed to facilitate hygienic operations according to the one-way flow direction, without backtracking, from the arrival of the raw materials at the premises to the finished product, and should provide for appropriate temperature and humidity conditions for the process and the product.

24. Premises and rooms should be designed with a means of dust control, since spices and dried aromatic herbs are likely to generate particulate matter that can be carried to other parts of the room or premises by air currents.

4.3 EQUIPMENT

25. Equipment should be installed so as to allow access for cleaning and to minimize transfer of dust particles to other pieces of equipment or to the environment.

26. The risk of contamination from equipment should be assessed and controlled. Wherever possible, forklifts, utensils, and maintenance tools for the finished product and packaging areas should be different from those used in the “raw” material area (e.g. prior to the microbial reduction treatment).

4.4 FACILITIES

4.4.8 Storage

27. Facilities for the storage of spices and dried aromatic herbs should be designed and constructed to prevent high humidity or other conditions that could result in moisture levels in product that would support the growth of moulds.

SECTION V - CONTROL OF OPERATION

5.1 CONTROL OF FOOD HAZARDS

28. Measures should be taken at each step in the food chain to minimize the potential for contamination of spices and dried aromatic herbs by microbial pathogens (including mycotoxin-producing moulds), chemical contaminants and other contaminants not intentionally added to food such as excreta, rodent hair, and insect fragments, which may compromise food safety or suitability.

5.2 KEY ASPECTS OF HYGIENE CONTROL SYSTEMS

5.2.2 Specific process steps

5.2.2.1 Mechanical Drying

29. Plants or parts of plants used for the preparation of spices and dried aromatic herbs may be dried mechanically (e.g. forced air drying), provided adequate measures are taken to prevent contamination of the raw material during the process. To prevent the growth of microorganisms, especially mycotoxin- producing moulds, a safe moisture level should be achieved as rapidly as possible.

30. Mechanical drying methods should be used instead of natural (open) air drying, where possible, to limit exposure of spices and dried aromatic herbs to environmental contaminants and to prevent growth of moulds. If hot air drying is used, the air should be free of contaminants and precautions should be made to prevent combustion gases from contacting the plant material or stored plant material in the area.

31. Drying time should be reduced as much as possible by using optimal drying conditions to avoid fungal growth and toxin production. The thickness layer of the drying source plant should be considered in order to consistently achieve a safe moisture level.

5.2.2.2. Cleaning of spices and dried aromatic herbs

32. Spices and dried aromatic herbs should be cleaned properly (e.g. culled and sorted) to remove physical hazards (such as the presence of animal and plant debris, metal and other foreign material) through manual sorting or the use of detectors, such as metal detectors. Raw materials should be trimmed to remove any damaged, rotten or mouldy material.

33. Debris from culling and sorting should be periodically collected and stored away from the drying, processing and packaging areas to avoid cross-contamination and attracting pests.

5.2.2.3 Microbial Reduction Treatments

34. In order to control microbiological contamination, appropriate methods of treatment may be used in accordance with the regulations set by the competent authority. When necessary to reduce risk, spices and dried aromatic herbs should be treated with a validated microbial reduction treatment prior to reaching the consumer in order to inactivate pathogens such as *Salmonella*. For additional information on validation, refer to the *Guidelines for the Validation of Food Safety Control Measures* (CAC/GL 69-2008). Commonly used methods involve the application of steam, fumigation or radiation. Where spices and dried aromatic herbs are irradiated, refer to the *Code of Practice for Radiation Processing of Food* (CAC/RCP 19-1979) and the *General Standard for Irradiated Foods* (CODEX STAN 106-1983).

35. Factors that should be controlled when using steam include exposure time and temperature. The process should ensure that all of the product achieves the desired temperature for the full length of time required. A drying step may be necessary to remove added moisture.

36. Factors that should be controlled when using irradiation include radiation dose and the size and shape of the package, as well as the penetrability of the packaging material to the type of radiation used. The process should ensure that all of the product is exposed to the minimum dose of radiation needed to provide the intended effect.

37. Factors that should be controlled when using fumigation treatments such as ethylene oxide or propylene oxide include product initial temperature, chamber temperature, chemical concentration, exposure time, vacuum and/or pressure, density of the product, and gas permeability of the packaging material. The process should ensure that all product is directly exposed to the gas for the full length of time required.

38. For pathogen inactivation treatments the adequacy of the selected control measure (thermal or non-thermal) and associated critical limits for processing should be determined, considering the increased heat resistance reported for *Salmonella* at low water activities and the increased resistance of spores to most microbial reduction treatments. In some cases, challenge studies may be needed to support validation. Once the lethality of the process is validated by scientific data, the establishment should periodically verify that the process continues to meet the critical limits during operation and the process criteria intended to achieve microbiocidal effects in the establishment.

5.2.3 Microbiological and other specifications

39. Refer to the *General Principles of Food Hygiene* and the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997).

40. Where appropriate, specifications for pathogenic and toxigenic microorganisms, chemical residues, foreign material, and decomposition should be established that take into account subsequent processing steps, the end use of the spice or dried aromatic herb and the conditions under which the product was produced.

41. When tested by appropriate methods of sampling and examination, the products should:

- Be free from pathogenic and toxigenic microorganisms in levels that may present a risk to health; and should comply with the provisions for food additives;
- Not contain any substances originating from microorganisms, particularly mycotoxins, in amounts that exceed the tolerances or criteria established by the Codex Alimentarius Commission or, where these do not exist, by the competent authority;
- Not contain levels of insect, bird or rodent contamination that indicate that spices and dried aromatic herbs have been prepared, packed or held under unsanitary conditions;
- Not contain chemical residues resulting from the treatment of spices and dried aromatic herbs in excess of levels established by the Codex Alimentarius Commission or, where these do not exist, by the competent authority;
- Comply with the provisions for contaminants, and with maximum levels for pesticide residues established by the Codex Alimentarius Commission or, where these do not exist, by the competent authority.

42. Verification activities should include, as necessary, appropriate environmental and/or product testing. (Refer to Annex I and Annex II).

5.2.4 Microbiological cross-contamination

43. Effective measures should be taken to prevent cross-contamination of uncontaminated spices and dried aromatic herbs by direct or indirect contact with potentially contaminated material at all stages of the processing. Raw products that may present a potential hazard should be processed in separate rooms, or in areas physically separate from those where end-products are being prepared. Spices and dried aromatic herbs that have undergone a microbial reduction treatment should be processed and stored separately from untreated spices and dried aromatic herbs. Equipment should not be used for both treated and untreated products without adequate cleaning and disinfection before use with treated products.

5.2.5 Physical and chemical contamination

44. Appropriate tools and methods should be used to remove physical hazards such as pebbles or heavier stones. To separate foreign matter from the product, air tables or gravity separators can be used for particles of the same size and different density. Sieves of different mesh may be used to obtain the size required for each product and to remove foreign matter.

45. Regardless of the type of separator used, the following parameters should be considered:, density, weight and size of particle, air speed, inclination of the sieve plate, vibration, etc. for the highest effectiveness of the procedure.

46. Magnets/metal detectors should be used to separate ferrous and non-ferrous/metallic matter from product or detect it in the product and remove the contaminated product. For good extraction, magnets should be as close as possible to the product. Magnets work more efficiently when product flows freely. If needed, more than one magnet should be placed in the line. Magnets should be cleaned frequently. Equipment should be designed in such a way as to prevent metals extracted by magnets from being swept by the flow of product. Spices and dried aromatic herbs should be arranged in a fine layer to facilitate this operation.

47. In all cases, particles identified by the metal detector should be removed and records kept of how much and what type of foreign matter was collected and when it was cleaned. This data should be used in determining how the metals or foreign matter got there in order to implement appropriate corrective measures.

5.3 INCOMING MATERIAL REQUIREMENTS

48. Spices and dried aromatic herbs or their source plants should not be accepted by the establishment if they are known to contain contaminants which will not be reduced to acceptable levels by normal processing procedures, sorting or preparation. Precautions should be taken to minimize the potential for contamination of the establishment and other products from incoming materials that may be contaminated. Plants, parts of plants, spices and dried aromatic herbs suspected of being contaminated with animal or human faecal material should be rejected for human consumption. Special precautions should be taken to reject spices and dried aromatic herbs showing signs of pest damage or mould growth because of the potential for them to contain mycotoxins such as aflatoxins.

49. Raw materials should be inspected and sorted prior to processing (foreign matter, odour and appearance, visible mould contamination). Laboratory tests, e.g. for moulds or pathogens such as *Salmonella*, should be conducted when necessary.

50. Spices and dried aromatic herbs and blends of these are often manufactured without a step that would inactivate pathogens. Spices and dried aromatic herbs should be obtained from approved suppliers. An approved supplier is one that can provide a high degree of assurance that appropriate controls in accordance with this Code have been implemented to minimize the possibility that chemical, physical and microbiological contamination occurs in the ingredient. Because of the diversity of production practices for spices and dried aromatic herbs, it is important to understand the controls in place for production of the incoming material. When the control measures used to produce the spices and dried aromatic herbs are not known, verification activities such as inspection and testing should be increased.

51. Consideration should be given to a program for testing spices and dried aromatic herbs to be used without a lethality step for relevant pathogens, e.g. *Salmonella*. Spices and dried aromatic herbs in which *Salmonella* is detected should not be used unless they are subjected to an effective microbial reduction treatment.

5.4 PACKAGING

52. Non-porous bags/containers should be used to protect the spices and dried aromatic herbs from contamination and the introduction of moisture, insects and rodents. In particular, the reabsorption of ambient moisture should be prevented. Contamination should be prevented by the use of liners where appropriate. It is recommended that new bags or containers be used for food contact packaging. If reusable bags/containers are used, they should be properly cleaned and disinfected before use. All bags/containers should be in good condition and particular attention paid to the potential for loose bag fibres that can become potential contaminants. Secondary containment bags/containers providing additional protection can be reused but should not have been previously used to hold non-food materials such as chemicals or animal feed.

53. Spices and dried aromatic herbs, e.g. dried chilli peppers, should not be sprayed with water to prevent breakage during packing. This may result in growth of moulds and microbial pathogens, if present.

54. Finished products may be packed in gas tight containers preferably under inert gases like nitrogen or under vacuum in order to retard possible mould growth.

5.7 DOCUMENTATION AND RECORDS

55. Refer to the *General Principles of Food Hygiene* (CAC/RCP 1-69) and the *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003).

5.8 RECALL PROCEDURES

56. Records should identify the source (or lot number) of incoming raw materials and link the source or lot to the lots of outgoing products to facilitate traceability/product tracing. Reference should also be made to *Principles for Traceability/Product Tracing as a Tool within a Food Inspection and Certification System* (CAC/GL 60-2006).

SECTION VI - ESTABLISHMENT: MAINTENANCE AND SANITATION

6.2 CLEANING PROGRAMMES

57. A cleaning and disinfection schedule should be established to ensure that all areas of the establishment are appropriately cleaned and that special attention is given to critical areas including equipment and materials. The air handling system should be included in the cleaning and disinfection schedule. The cleaning and disinfection schedule should describe whether to use wet or dry cleaning. The presence of water in the dry processing environment can result from improper use of water during cleaning.

58. Dry cleaning is the preferred means of cleaning establishments handling spices and dried aromatic herbs, since the use of water can enhance the probability of contamination from pathogens such as *Salmonella.* Dry cleaning should collect, remove and dispose of residues without redistributing them or cross-contaminating the environment.

59. Dry cleaning is especially important in older establishments in which, in spite of regular maintenance, there may be a potential for the presence of cracks or other harbourage sites that may be difficult to eliminate. Even if residues of spices and dried aromatic herbs enter such a site, potential problems can be minimized if the residues and the sites are dry and kept dry. Once water enters the harbourage site, microbial growth can occur and the potential risk of contamination to the environment and eventually to the product is increased.

60. Wet cleaning may be appropriate in certain circumstances, e.g. when *Salmonella* has been detected in the environment. Wet cleaning should be followed by disinfection with preferably an alcohol-based disinfectant that will rapidly evaporate after contact. Suitable, alternative disinfectants that are not alcohol-based may be used where appropriate. Wet cleaning should be followed by thorough drying.

6.3 PEST CONTROL SYSTEMS

61. Drains should be trapped or otherwise equipped with appropriate means to prevent entry of pests from drainage systems.

6.4 WASTE MANAGEMENT

62. Care should be taken to prevent access to waste by pests.

6.5 MONITORING EFFECTIVENESS

63. Verification of hygienic control measures should include an environmental monitoring program that has been designed to identify pathogens such as *Salmonella* in the processing areas. (Refer to Annex II.)

SECTION VIII – TRANSPORTATION

64. Refer to the *Code of Practice for the Packaging and Transport of Fresh Fruit and Vegetables* (CAC/RCP 44-1995). In addition, bulk transport of spices and dried aromatic herbs, such as by ship or rail, should be well ventilated with dry air to prevent moisture condensation, e.g. resulting from respiration and when the vehicle moves from a warmer to a cooler region or from day to night. Prior to bulk transport, the products must be dried to a safe moisture level to prevent the growth of moulds and pathogenic bacteria.

8.1 GENERAL

65. Spices and dried aromatic herbs should be stored and transported under conditions that maintain the integrity of the container and the product within it. Vehicles should be clean, dry, and free from infestation. Spices and dried aromatic herbs should be loaded, transported, and unloaded in a manner that protects them from any damage, contamination or water. Care should be taken to prevent condensation when unloading spices and dried aromatic herbs from a refrigerated vehicle or while taking out of a cold storage. In warm, humid weather, the products should be allowed to reach ambient temperature before exposure to external conditions. Spices and dried aromatic herbs that have been spilled are vulnerable to contamination and should not be used as food.

Appendix V

PROJECT DOCUMENT

Revision of the *General Principles of Food Hygiene* (CAC/RCP 1-1969) and its HACCP Annex

1. Purpose and Scope of the new work

The *General Principles of Food Hygien*e (CAC/RCP 1-1969) and its Annex: Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application provide food business operators worldwide with the basis for producing food that is safe and suitable for consumption. Since its inception in the early 1970s, HACCP has become the universal system for the control of food safety, on which most regulatory food control systems and international food safety standards (e.g. ISO 22000) are based. HACCP, or a similar approach of identifying hazards and establishing controls to prevent them, has also been used in guidance on the safety of feed and drinking water.

2. Relevance and Timeliness

The General Principles of Food Hygiene (GPFH) is the basis for all codes of hygienic practice developed by CCFH. This standard is widely used and referenced internationally. There are several initiatives ongoing to update, in particular, the concept of HACCP. However, because *Codex Alimentarius* standards are the basis for international acceptance, it is important for the Committee to ensure that the GPFH and the Annex on HACCP provide the best available guidance based on current scientific information.

At its 46th session, CCFH agreed to explore further if GPFH and its HACCP Annex needed to be revised. An eWG, co-chaired by Thailand and France, established a questionnaire in order to identify specific items that could benefit from improvement through the *Codex alimentarius* standardization process.

3. Main aspects to be covered

As GPFH and its HACCP Annex are currently recognized for providing a common ground for the control of food safety worldwide, the whole document deserves a regular update. The revision should consider the issues, identified by the electronic working group[1], and other aspects that might arise during the course of the work. Those potential improvements should be aimed at making the standard easier to understand, to implement across the food chain and to clarify any aspects, where necessary. The revision should not address managerial aspects.

4. Assessment against the Criteria for the establishment of work priorities

4.1 General criterion: Consumer protection from the point of view of health, food safety, ensuring fair practices in the food trade and taking into account the identified needs of developing countries.

The proposed work is directed at revising the most central standard in food hygiene, in order to make it more logical and user-friendly and to better address emerging and new hazards. Furthermore, such a revision could lead to help implementation by small and/or less-developed food businesses in both developed and developing countries and to better encompass the whole food production sector.

4.2 Diversification of national legislations and apparent resultant or potential impediments to international trade

Food safety legislation widely refers to the Codex HACCP principles, as do many international standards giving food businesses access to more lucrative markets, but as the application of the HACCP principles can differ among countries it can cause impediments to international trade. A document that fosters a more consistent approach can reduce impediments to international trade. Furthermore, a harmonized glossary could improve common understanding through the whole food chain and between all kinds of agro-food businesses.

4.3 Scope of work and establishment of priorities between the various sections of the work

The proposed work would consist on the revision of the different sections of the standard CAC/RCP 1-1969, e.g. its General Introduction, the GPFH part and the HACCP Annex. Indeed, it appears that the whole structure of the document needs to be rearranged, particularly because of concepts that seem to be common for the two sections. Several improvements have also been proposed for each part of the standard by participants of the eWG on the need to revise GPFH and its HACCP Annex.

[1] CX/FH 15/47/9

The proposed schedule is as follows:

a) Revision of the General Introduction to clarify concepts and terms that are useful in the frame of both GPFH and HACCP, and to avoid repetitions, and revision of the HACCP annex, as this section is the most critical for food businesses and needs urgent modification to encompass emerging issues;

b) Revision of the GPFH, taking into account the improvements of HACCP; and

c) Final verification of the soundness and consistency of the whole revised standard.

4.4 Work already undertaken by other international organizations in this field

In the ISO, work has recently started on a revision of its HACCP standard, ISO 22000. ISO 22004 is now the most updated available standard in this field.

4.5 Amenability of the subject of the proposal to standardization

This revision concerns the most central food hygiene standard of Codex.

4.6 Consideration of the global magnitude of the problem or issue

This standard is applied worldwide to practically all commercial food businesses. If a revision can make it more effective and user-friendly, results will include improved food safety, more efficient food control, and increased food trade. It can provide a sound common ground for all food hygiene sectorial standards and codes of hygienic practice.

5. Relevance to the Codex strategic objectives[2]

The proposed work directly relates to the following Codex Strategic Goals from the 2014-2019 Strategic Plan.

Strategic goal 1: Establish international food standards that address current and emerging food issues

The revision of these texts is consistent with all three Objectives of this strategic goal. At the 45th and 46th Sessions of the CCFH, the revision of the GPFH and HACCP texts was indicated as a top priority in the Committee's forward work plan. Therefore, an eWG was settled to explore further that possibility, with massive involvement of Codex members and observer organizations. Various stakeholders have been actively involved in identifying issues of concern that could be addressed in a revision. The revised standard will provide important information for all countries and food businesses of all kinds in order to achieve a higher level of food safety and suitability.

Strategic goal 2: Ensure the application of risk analysis principles in the development of Codex standards

Risk analysis as it applies to food safety across the food chain is an internationally accepted discipline and forms an integral part of any well-designed food safety control system. Through an active involvement of scientific and technical experts from many Codex members and observers we aim for a revised standard addressing all recent developments in the field of food safety risk management. eWG members participation has already identified gaps in addressing hazards e.g. from allergens or mycotoxins.

Strategic goal 3: Facilitate the effective participation of all Codex Members

The revision of these universal texts should generate great interest and broad participation from all members. Through the revision process, it should be kept in mind that one of the main challenges is to produce a user-friendly document that could be used as widely as possible. Specific attention should be granted to small enterprises and to developing countries.

Strategic goal 4: Implement effective and efficient work management systems and practices

More expeditious and efficient work by Codex is necessary to provide members and international organizations with the standards, guidelines and recommendations that they need. During the revision, all working documents and electronic discussions will be distributed in a timely and transparent manner, using web-based technologies available freely to all.

This strategic goal is one of the core objectives of the revision of this standard, as it will provide a solid ground for all Codex work related to food hygiene.

6. Information on the relation between the proposal and other existing Codex documents

The General Principles of Food Hygiene (CAC/RCP 1-1969) and its Annex: Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application are relevant to many Codex texts including Codes of Hygienic Practice.

[2] ftp://ftp.fao.org/codex/Publications/StrategicFrame/Strategic_plan_2014_2019_EN.pdf

The following documents could be considered for reference within the revised document: "*Principles and Guidelines for the Establishment and Application of Microbiological Criteria Related to Foods* (CAC/GL 21-1997)", "*Guidelines for the Validation of Food Safety Control Measures (CAC/GL 69-2008)*", and the "*Code of practice for fish and fishery products* (CAC/RCP 52-2003)".

7. Identification of any requirement for and availability of expert scientific advice

FAO/WHO expert scientific advice is necessary on water with respect to food safety and suitability throughout the food chain, and other aspects that might arise in the course of the work.

8. Identification of any need for technical input to the standard from external bodies so that this can be planned for

Technical input is expected from the International Commission of Microbiological Specifications for Foods (ICMSF), the International Organization for Standardization (ISO), and other international organizations. Such input is important as these organizations would be among the organizations that would be applying the revised information on the general principles for food safety control systems.

9. The proposed time-line for completion of the new work, including the start date, the proposed date for adoption at Step 5, and the proposed date for adoption by the Commission, the timeframe for developing a standard should not normally exceed five years.

Approval of new work: 2016, adoption at Step 5: 2019, adoption at Step 8: 2021.

Appendix VI

PROJECT DOCUMENT

PROPOSAL FOR NEW WORK ON
***CODE OF HYGIENIC PRACTICE FOR FRESH FRUITS AND VEGETABLES* (CAC/RCP 53-2003)**

1. Purpose and Scope of the new work

The purpose of the proposed new work is to revise *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003).

2. Relevance and Timeliness

The Code of Hygienic Practice for Fresh Fruit and Vegetables was adopted by CAC in 2003. Since then, many Codes of Hygienic Practice for specific fruit and vegetables were adopted and added as Annexes to the Code. However, slightly different wording was used, text was sometimes duplicated and some of the provisions do not fit the scope of the main code. Continued outbreaks of foodborne illness attributed to fresh produce have led to the identification of new sources of contamination and additional control measures to minimize the potential for illness.

3. Main aspects to be covered

A number of changes will be considered.The code will restructured with the inclusion of new definitions, specific provisions regarding hygiene in the environment and cleaning programs. The objective and the scope need to be expanded to include provision throughout the food chain from "primary production to consumer" as well as to accommodate the inclusion of specific provisions from the Annexes.

4. Assessment against the criteria for the establishment of work priorities

4.1 General criterion: Consumer protection from the point of view of health, food safety, ensuring fair practices in the food trade and taking into account the identified needs of developing countries.

The proposed work falls under the general criterion for establishment of work priorities, because the use of the Code will strengthen protection of consumers by ensuring food safety. This work also seeks to promote fair practices in food trade taking into account the identified needs of developing countries.

The proposed work is directed primarily at control of microbial hazards in fresh fruit and vegetables. Fresh fruits and vegetables are part of the basic diet worldwide, and therefore widely traded. Through updating the information and structure of the document, the revision of this Code aims to facilitate understanding of the guidance in matters of hygiene for fresh fruits and vegetables.

Other criteria applicable to general subjects for the establishment of work priorities of the Procedural Manual:

4.2 Diversification of national legislations and apparent resultant or potential impediments to international trade It is covered by the preceding paragraph.

4.3 Scope of work and establishment of priorities between the various sections of the work

See above section on purpose and scope.

*4.4 Work already undertaken by other international organizations in this field*No other similar work undertaken by other international organizations.

4.5 Amenability of the subject of the proposal to standardization

It is amenable to standardization – the Code is already adopted, and the revisions will be simply to streamline the Code – there should be no problem with standardization.

4.6 Consideration of the global magnitude of the problem or issue

It is covered by the preceding paragraph.

5. Relevance to Codex Strategic objectives[1]

The proposed work falls under 3 Codex Strategic Goals:

Strategic goal 1: Establish international food standards that address current and emerging food issues.

[1] ftp://ftp.fao.org/codex/Publications/StrategicFrame/Strategic_plan_2014_2019_EN.pdf

Strategic goal 2: Ensure the application of risk analysis principles in the development of Codex standards: this work will help in establishing of risk management options and strategies to prevent outbreaks from the consumption of fresh fruits and vegetables.

Strategic goal 4: Implement effective and efficient work management system and practices: reviewing and implementing the recommended practices from primary production to consumption can help the control of microbiological contamination in fresh fruits and vegetables.

6. Information on the relationship between the proposal and other existing Codex documents

The revised Code will build on the *General Principles of Food Hygiene* (CAC/RCP 1-1969), the *Guidelines on the Application of General Principles of Food Hygiene to the Control of Viruses in Food* (CAC/GL 79-2012), the *Code of Practice for Packaging and Transport of Fresh Fruits and Vegetables* (CAC/RCP 44-1995), the *Code of Practice for the Processing and Handling of Quick Frozen Foods* (CAC/RCP 8-1976) and on *Code of Hygienic Practice for Fresh Fruits and Vegetables* (CAC/RCP 53-2003).

7. Identification of any requirement for and availability of expert scientific advice

Additional scientific advice is not necessary at this moment.

8. Identification of any need for technical input to the standard from external bodies so that this can be planned for

There is no need for additional technical input from external bodies.

9. The proposed timeline for completion of the new work, including the starting date, proposed date for adoption at step 5 and the proposed date for the adoption by the Commission, the timeframe for developing a standard should not normally exceed five years.

Approval of new work: 2016, adoption at Step 5: 2017, adoption at Step 8: 2018.

Appendix VII

CCFH FORWARD WORKPLAN

Ranking	Title of Work	Last Revision	Currency of Informa-tion (Yes/No)[1]	Positive impact of new work on public health (Yes/No)	Project document/ discussion paper (Yes/No)	Public Health Risk (20/14/8)	Trade Impact (10/5/4/ 2/0)	Comments	FAO/WHO assistance needed? (Yes/No)	Total
	Code of Hygienic Practice for Meat (CAC/RCP 58-2005)	2005	Yes	Yes	No	20	10			30
	Control of Verotoxigenic *E. coli* in Beef	N/A	Yes	Yes	No	20	10			30
	Code of Hygienic Practice for Milk and Milk Products (CAC/RCP 57-2004)	2009	No			14	10			24
	Development of an annex on tomatoes for the Code of Hygienic Practice for Fresh Fruits and Vegetables (CAC/RCP 53-2003)	N/A	Yes	Yes	No	14	5			19
	Code of Hygienic Practice for Eggs and Egg Products (CAC/RCP 15-1976)	2007	No			14	5			19
	Code of Hygienic Practice for Precooked and Cooked Foods in Mass Catering (CAC/RCP 39-1993)	1993	No			14	5			19
	Code of Hygienic Practice for the	2001	No			8	10			18

[1] Currency of information: Is there new information/data that would justify the needto review the existing code(s) or establish a new one? Are there new technologies that would justify the need to review existing codes or establish a new one? If there is an existing code in place and a determination is made that the code is sufficient, no new work should proceed.

Ranking	Title of Work	Last Revision	Currency of Informa-tion (Yes/No)[1]	Positive impact of new work on public health (Yes/No)	Project document/ discussion paper (Yes/No)	Public Health Risk (20/14/8)	Trade Impact (10/5/4/ 2/0)	Comments	FAO/WHO assistance needed? (Yes/No)	Total
	Transport of Food in Bulk and Semi-packed Food (CAC/RCP 47-2001)									
	Code of Hygienic Practice for Low-acid and Acidified Low-acid Canned Foods (CAC/RCP 23-1979) Code of Hygienic Practice for Aseptically Processed and Packaged Low-acid Foods (CAC/RCP 40-1993) Guideline Procedures for the Visual Inspection of Lots of Canned Foods for Unacceptable Defects (CAC/GL 17-1993) Code of Hygienic Practice for Canned Fruit and Vegetable Products (CAC/RCP 2-1969)	1993 1993 1993 1969	No			8	10			18
	Code of Hygienic Practice for the Storage of Cereals	N/A	Yes	No	Yes	8	5			13
	Development of an annex on carrots for the Code of Hygienic Practice for Fresh Fruits and Vegetables (CAC/RCP 53-2003)	N/A	No			8	5			13
	Code of Hygienic Practice for	2001	No			8	5			13

Ranking	Title of Work	Last Revision	Currency of Informa-tion (Yes/No)[1]	Positive impact of new work on public health (Yes/No)	Project document/ discussion paper (Yes/No)	Public Health Risk (20/14/8)	Trade Impact (10/5/4/ 2/0)	Comments	FAO/WHO assistance needed? (Yes/No)	Total
	Bottled/Packaged Drinking Waters (other than natural mineral waters)(CAC/RCP 48-2001)									
	Code of Hygienic Practice for Refrigerated Packaged Foods with Extended Shelf-life (CAC/RCP 46-1999)	1999	No			8	5			13
	Code of Hygienic Practice for the Processing of Frog Legs (CAC/RCP 30-1983)	1983	No			8	2			10