

Risk to Consumers From *Salmonella* in Meat Produced by Small Throughput Poultry Abattoirs That Apply Flexibilities in Sampling

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FSA Research and Evidence

Introduction

UK-registered Food Business Operators (FBOs) must adhere to the (assimilated) [Commission Regulation EC 2073/2005 of 15 November 2005 on microbiological criteria on foodstuffs](#) which details the established Microbiological Criteria (MC) for foodstuffs. This assimilated regulation requires the Food Standards Agency (FSA) as the Competent Authority to verify FBOs' compliance with the MC sampling and testing requirements.

With reference to *Salmonella* testing in broiler/turkey carcasses, a meat processing establishment had to meet a target of less than 7 positive samples out of 50 in 2005, which was subsequently reduced to less than 5 positive samples in 2011. The regulation also allows the Competent Authority such as the FSA to reduce or eliminate sampling requirements in smaller poultry establishments, when justified on the basis of a risk analysis. The FSA then conducted an initial risk assessment and devised a proportionate sampling regime based on throughput, where medium-sized poultry slaughterhouses (slaughtering between 1 million and 7.5 million turkeys or broilers per year) could sample less often and smaller slaughterhouses (slaughtering less than 1 million birds per year) were exempted from MC sampling.

The risk assessment on *Salmonella* MC sampling and testing was commissioned by the FSA (FS301045) and carried out in 2019 by BAE Systems plc (Hill et al., 2020). A recent FSA regulatory audit was carried out in July 2023 to assess the effectiveness of the FSA arrangement for Microbiological Criteria sampling and testing (MCST). The audit concluded that there are significant weaknesses in the framework of governance, risk management and control of the micro criteria sampling system such that

it could become inadequate or effective. This review therefore reviews the evidence upon which the original risk assessment was based to aims to update determine if its conclusions are still valid.

Scope of the review

The original risk assessment “An analysis of the need for Microbiological Criteria sampling of smaller Food Business operators” assessed the following question *“Is the current ‘staged approach’ of Salmonella sampling in slaughterhouses and monitoring in cutting plants still valid given the amendments to Regulation 2073/2005 laid out in Regulation 1086/2011?”*

Upon review, it was found that the original risk assessment appeared to consider requirements for slaughterhouses only (i.e. not for cutting plants), even though the conclusions then referred to both. The requirement set by the FSA for the testing of *Salmonella* spp. in broilers and turkeys, as detailed in the FSA’s Manual of Official Controls, is in line with assimilated regulation (EC) No 2073/2005. However, in the FSA’s Manual of Official Controls, there is a different criterion for the exemption to testing for small slaughterhouses and the criterion for exemption to testing for small establishments producing minced meat, meat preparations and fresh poultry meat in small quantities (i.e. cutting plants).

- Small slaughterhouses: Annual throughput of turkeys or broilers is below 1,000,000 (less than 20,000 per week).
- Small cutting plants: Less than 2 metric tonnes per week combined minced meat and meat preparations intended to be eaten cooked.

The original risk assessment refers to “FBOs”, which would imply cutting plants as well as slaughterhouses, but did not incorporate any evidence to support the assessment of risk from cutting plants. Although small slaughterhouses are not currently testing, the birds slaughtered there are sampled at flock level under the National Control Plan for *Salmonella*, providing an additional layer of monitoring on the potential impact of *Salmonella* to public health. In addition, because cutting plants may handle poultry originating from non-UK slaughterhouses the risk from this meat is outside of the scope of the previous RA and needs to be considered separately.

There is no reference to the exemption criterion for cutting plants within the original risk assessment and the terminology of data used in the original risk assessment is written as though it applies to slaughterhouses only. There is currently no data available for microbiological testing that is carried out in small cutting plants.

As such, separate assessment of the exemption of small cutting plants (i.e. those producing less than 2 metric tonnes per week of combined minced meat and meat preparations intended to be eaten cooked) from *Salmonella* testing, and of cutting plants handling poultry meat that has been imported and not been through the testing that a UK slaughterhouse plant undertakes, or the NCP, may be needed.

On this basis, this review has been completed on the need for microbiological criteria sampling of smaller food business operators of slaughterhouses only and has excluded small cutting plants.

Methodology

[Figure 1](#) describes the approach that was used to conduct the review of the original risk assessment. We reviewed some of the evidence and assumptions that were used to make the original conclusion, and where applicable, replaced these with current available information. We then reviewed the impact of the current results to make previous conclusions and recommendations.

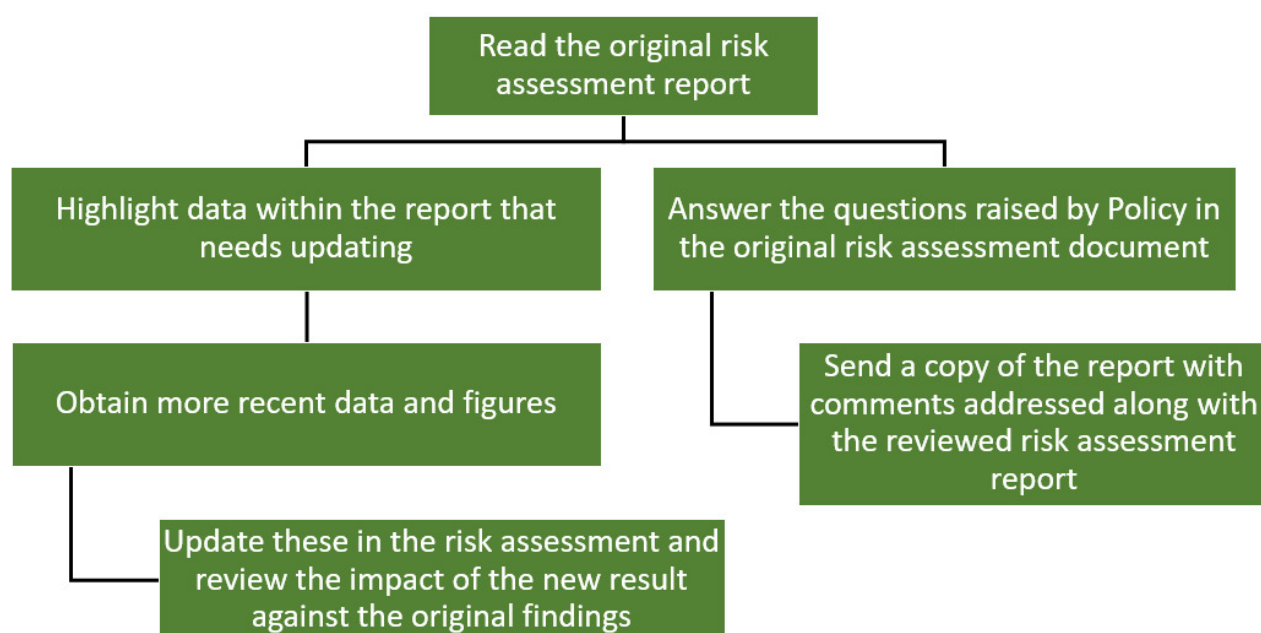


Figure 1. Methodology for the review of the original risk assessment.

Review of evidence

Has there been any change to the number of *Salmonella* positives which is acceptable in regulation?

As per section 2.1.5 (Process Hygiene Criteria) of [Commission Regulation \(EC\) No 2073/2005](#); the acceptable number of *Salmonella* positives is still 5 out of 50 samples, for poultry carcasses of broilers and turkeys. There has been no change to the microbiological criteria for foodstuffs with which FBOs must comply since the original assessment was completed.

Evidence from the original risk assessment that was reviewed.

“As contamination levels across the EU fell, the acceptable number of Salmonella positives was reduced from 7 to 5 out of 50”.

Is the prevalence of *Salmonella* Enteritidis (SE) and *Salmonella* Typhimurium (STM) from National Control Programme (NCP) testing still below the EC target of 1% flock prevalence?

Yes. In 2022, the estimated prevalence of regulated serovars of *Salmonella* tested under the NCP for chicken broiler flock and fattening turkey flock were 0.03% (15/45,741), and 0.10% (2/2,017) respectively. This falls below the EC target of a maximum of 1% flock prevalence of SE and STM (APHA, 2023). In 2016, these were 0.01% and 0.26% respectively.

The NCP for *Salmonella* includes the testing of commercial chicken and turkey flocks across the UK. This was implemented to monitor and control the prevalence of *Salmonella* in order to meet the target for reduction of *Salmonella* prevalence that was set in the assimilated EU regulations: [Regulation \(EU\) 200/2012](#), amended in 2019, [Regulation \(EU\) 2019/268](#) for chicken (*Gallus gallus*) flocks, [Regulation \(EC\) No. 2160/2003](#) and [Regulation \(EU\) No. 1190/2012](#) for turkey flocks. NCP was commissioned for chicken breeding flocks, laying flocks and broiler flocks as well as for turkey breeding and fattening flocks in Great Britain.

The annual target is a maximum of 1% testing positive for regulated serovars of *Salmonella* in adult chicken breeding flocks, broiler flock, turkey breeding and turkey fattening flocks. The regulated serovars are *Salmonella* Enteritidis (SE) and *Salmonella* Typhimurium (STM) including monophasic strains of STM.

[Table 1](#) shows variable prevalence of all *Salmonella* serotypes isolated from broilers and turkey flocks in the UK between 2019 and 2022. The prevalence of *Salmonella* in broilers ranged from 2.41% to 4.28% (with 3.08% in 2019 and 4.28% in 2023), while that of turkey flock range from 3.76% to 7.44% (with 7.44% in 2019, and 4.81% in 2023).

Table 1. The Prevalence of all *Salmonella* isolated from Chicken and Turkey flocks under the NCP testing between 2019-2022 (APHA, 2023).

Year	Broiler flock	Turkey fattening flock
2019	3.01%	7.44%
2020	3.38%	4.76%
2021	2.41%	3.76%
2022	4.28%	4.81%

[Table 2](#) shows that the prevalence of the regulated serovars of *Salmonella* have consistently been below the EC target of 1% flock prevalence between 2019 to 2022.

Table 2. The Prevalence of regulated *Salmonella* isolated from Chicken and Turkey flocks under the NCP testing between 2019-2022 (APHA, 2023).

Year	Broiler flock	Turkey fattening flock
2019	0.03%	0.00%
2020	0.01%	0.00%
2021	0.03%	0.48%
2022	0.03%	0.10%

Evidence from the original risk assessment that was reviewed.

*“SE and STM represent around 1% of all *Salmonella* isolates from NCP testing”.*

*“STM and SE are rarely isolated from the NCP for *Salmonella* in broilers (APHA, 2017), and the 2016 incidence of these serotypes - 0.01% (5/36,505) in broiler flocks and 0.26% (6/2270) in fattening turkey flocks - was well below the EC target of 1% flock prevalence (EC Regulation 2160/2003). Thus, it is relatively straightforward to discount the need for MC sampling in smaller FBOs on the basis of FSC 1.28 alone”.*

“The latest 2016 results from the National Control Programme in broiler flocks isolated STM and SE from five flocks out of 36,505 tested (0.01%) (APHA, 2017)”.

“In 2016, six fattening turkey flocks out of 2,270 tested (0.26%) were found positive for regulated serovars (APHA, 2017)”.

Do small abattoirs still contribute no more than 1% of the total UK's poultry production?

Evidence from the original risk assessment that was reviewed.

"Only 1% of UK poultry production does not fall under FSA's requirements for MC sampling"

"We assessed the contributions of smaller and larger FBOs by analysing FSA throughput data for all poultry slaughterhouses and cutting plants¹ operating between June 2017 and May 2018...."

The total throughput of poultry production from slaughterhouses in the UK in 2022 was 989,722,027. Out of this, approximately 95% were processed from large poultry slaughterhouses (produces greater than 7.5 million birds per year), 4.2% in medium slaughterhouses (produces between 1 and 7.5 million birds per year) and 0.75% in small poultry slaughterhouses (less than 1 million birds per year).

Out of the 59 approved slaughterhouses, the 26 small slaughterhouse that do not sample contributes 7,448,736 (0.75%) of the total poultry production in the UK. If all products from these FBOs are contaminated, it will add an extra 7.5 million (less than 1%) to the carcass contamination prevalence in the UK.

Have the sampling frequencies for Food Business Operators, based on their size, changed?

Sampling requirements have not changed. As per Section 3.2 of [Commission Regulation \(EC\) No 2073/2005](#):

"FBOs are still required to sample weekly, however, sampling can be reduced to fortnightly if satisfactory results are obtained for 30 consecutive weeks".

"However, when justified on the basis of a risk analysis and consequently authorised by the competent authority, small slaughterhouses and establishments producing minced meat, meat preparations and fresh poultry meat in small quantities may be exempted from these sampling frequencies".

¹ Cutting plants have been excluded from the scope of this review.

The reference (FSA 2018) is no longer applicable as it references the Meat Industry Guide which was withdrawn on 06 November 2020. The equivalent now would be the [Food Standards Agency Manual for Official Controls](#).

Extract from the Manual for Official Controls - Chapter 4.3 Verifying Operators Own Checks, Section 3.4.2 Testing Requirements – Poultry slaughterhouses is below, in [Table 3](#).

“Slaughterhouses with an annual throughput below 1,000,000 broilers or turkeys (less than 20,000 broilers/turkeys per week) are exempt from *Salmonella* testing requirements.”

Table 3. Extract from the Manual for Official Controls - Chapter 4.3 Verifying Operators Own Checks, Table 3.4.3.2. Sampling frequency in poultry meat carcasses.

Category and size	Annual throughput of turkeys or broilers	Initial sampling frequency for <i>Salmonella</i> (One sample is three neck skins)	Reduced sampling frequency for <i>Salmonella</i> if results are satisfactory (One sample is three neck skins)
Standard size 1	Over 7,500,000 (>150,00/week)	5 samples once a week for 30 weeks for each species (30 x 5 = 150 samples)	5 samples once every 2 weeks for each species
Small size 2	Below 7,500,000 but over 1,000,000 (20,000/week)	5 samples once every 4 weeks for each species	No reduction
Small size 3	Below 1,000,000 (<20,000/week)	Not required	Not required

Evidence from the original risk assessment that was reviewed.

“Larger FBOs must sample weekly; however satisfactory results after 30 weeks allow them to only sample every two weeks. Medium-sized FBOs (slaughtering between 1 and 7.5 million turkeys or broilers per year) sample every four weeks (FSA 2018). Smaller FBOs (slaughtering less than 1 million birds per year) are not required to sample for Salmonella”.

Are at least 80% of UK poultry slaughterhouse operators still members of the British Poultry Council (BPC)?

Yes. The BPC was contacted requesting up-to-date data on their members. Confirmation was received that this figure remains at 80%. The BPC represents around two thirds of UK poultry meat production (as quoted by the BPC). Members are still adhering to the requirement to conduct MC sampling on a weekly basis, where applicable.

Evidence from the original risk assessment that was reviewed.

“BPC members represent at least 80% of UK poultry production by total heads slaughtered, and most of the poultry produced in the UK that must undergo MC sampling. The companies that submitted results own fifteen slaughterhouses between them and all conduct MC sampling on a weekly basis.”

Have micro testing results from BPC members changed since the original assessment?

[Table 4](#) below shows the micro testing results from BPC members taken from the 2019 risk assessment, compared against 2023 micro testing results from BPC members.

Table 4. Summary of results from industry over 12-month period (Jun 2017 – Jun 2018), compared against results from industry over 12-month period (Jan 2023 – Dec 2023).

	Jun 2017 – Jun 2018	Jan 2023 – Dec 2023
Number of positive samples* ³	79 total (4 <i>Salmonella</i> Typhimurium, 0 <i>Salmonella</i> Enteritidis)	125 total (No <i>Salmonella</i> Typhimurium, No <i>Salmonella</i> Enteritidis)
Estimated number of samples	3900* ¹	8478* ²
Estimated incidence	2% overall 0.1% <i>Salmonella</i> Typhimurium or <i>Salmonella</i> Enteritidis	1.47% overall 0% <i>Salmonella</i> Typhimurium or <i>Salmonella</i> Enteritidis

*¹ Estimated number of samples – 5 samples per week for 52 weeks across 15 slaughterhouses.

*² Estimated number of samples figure provided by the BPC.

*³ Confirmation was not obtained from the BPC on the approval status of the laboratories that were used for this testing.

The most recent results of the industry analysis suggest that *Salmonella* prevalence in 2023 is of a lower magnitude compared to the reported findings in 2019, with the increase in the number of positive samples negated by the fact that the estimated number of samples taken has

dramatically increased since 2017 when the first set of results were reported from. Of note is that no isolates were regulated serovars (SE and STM).

Evidence from the original risk assessment that was reviewed.

"We summarise the reported Salmonella isolates from Microbiological Criteria sampling over 12-month period (June 2017 – May 2018)."

Is the UK still meeting the performance objective (PO) of 2 to 5% carcass prevalence for *Salmonella*, based on Process Hygiene Criteria 2.1.5 laid out in Regulation 2073/2005?

Yes. With carcass contamination rates suggesting a prevalence of 2 – 3%, and with the prevalence of regulated serovars of *Salmonella* well below the EU target of a maximum of 1% flock prevalence, the statement that "...the UK as a Member State is in all likelihood meeting the working PO of 2-5%" is still accurate. However, as of 1st February 2020, the UK is no longer a member of the EU.

This has been based on the following evidence (*in italics*) from the original risk assessment that was reviewed.

"Given that

i) the carcass contamination rates suggest a prevalence in the region of 2-3%,

This statement remains unchanged, as the data from the original report is the most up-to-date data available. Carcass contamination rates suggest a prevalence of all *Salmonella* serovars in the region of 2 – 3%.

ii) national flock prevalence is lower than in 2008 and is around the EU target of 1% flock prevalence, and

As per the NCP, National flock prevalence of all *Salmonella* isolates in 2022 for broiler chicken flocks and turkey fattening flocks was 4.28% and 4.81% respectively. The 2008 reference above refers to the EFSA Baseline survey (European Food Safety Authority, 2010).

The estimated prevalence of regulated serovars of *Salmonella* tested under the NCP for chicken broiler flock was 0.03% and 0.10% for turkey fattening flocks. Both these falls below the EC target of a maximum of 1% flock prevalence of SE and STM (APHA, 2023).

iii) that the sensitivity Se of the pooled test is unlikely to be 100%,

We suggest that the UK as a Member State is in all likelihood meeting the working PO of 2-5%."

The calculations used to work out sensitivity of pooled tests remain unchanged due to there being no change to the Process Hygiene Criteria – section 2.1.5 of [Commission Regulation \(EC\) No 2073/2005](#); the acceptable number of *Salmonella* positives are still 5 out of 50 samples, for poultry carcasses of broilers and turkeys.

What is the current relative contribution of smaller FBOs to the UK's contamination rate, using the same calculation from the original risk assessment?

The original risk assessment calculated that 50 *Salmonella* infections per year were attributed to production by smaller poultry FBOs. Using the same methodology as the authors in the original risk assessment, inputting data from 2022, the relative contribution of smaller FBOs to the UK's contamination rate was calculated as 10 *Salmonella* infections per year – a reduction of 40 annual infections.

On this basis, the following statement from the original risk assessment is still accurate:

"We thus conclude that unless contamination rates are significantly higher than the UK national average, smaller FBOs present a small contribution to Salmonella infections from consuming domestic poultry".

[Figure 2](#) below shows the steps taken to calculate the relative contribution of smaller FBOs to the UK's contamination rate, supported by the calculations stated in Appendix A. This methodology mimics the same method that was used in the original risk assessment. No verification has taken place on the appropriateness of the original calculation, or the decision of the original authors to use this calculation as opposed to other variations (such as per-portion consumption risk to consumers etc). The steps were repeated using current available data to be able to make a like-for like comparison.

Total throughput for all poultry slaughterhouses in 2022 was 989,722,027 birds (poultry and turkey). Of this, 7,448,736 were from small FBOs, equating to 0.75% of total throughput for all carcasses processed in 2022.

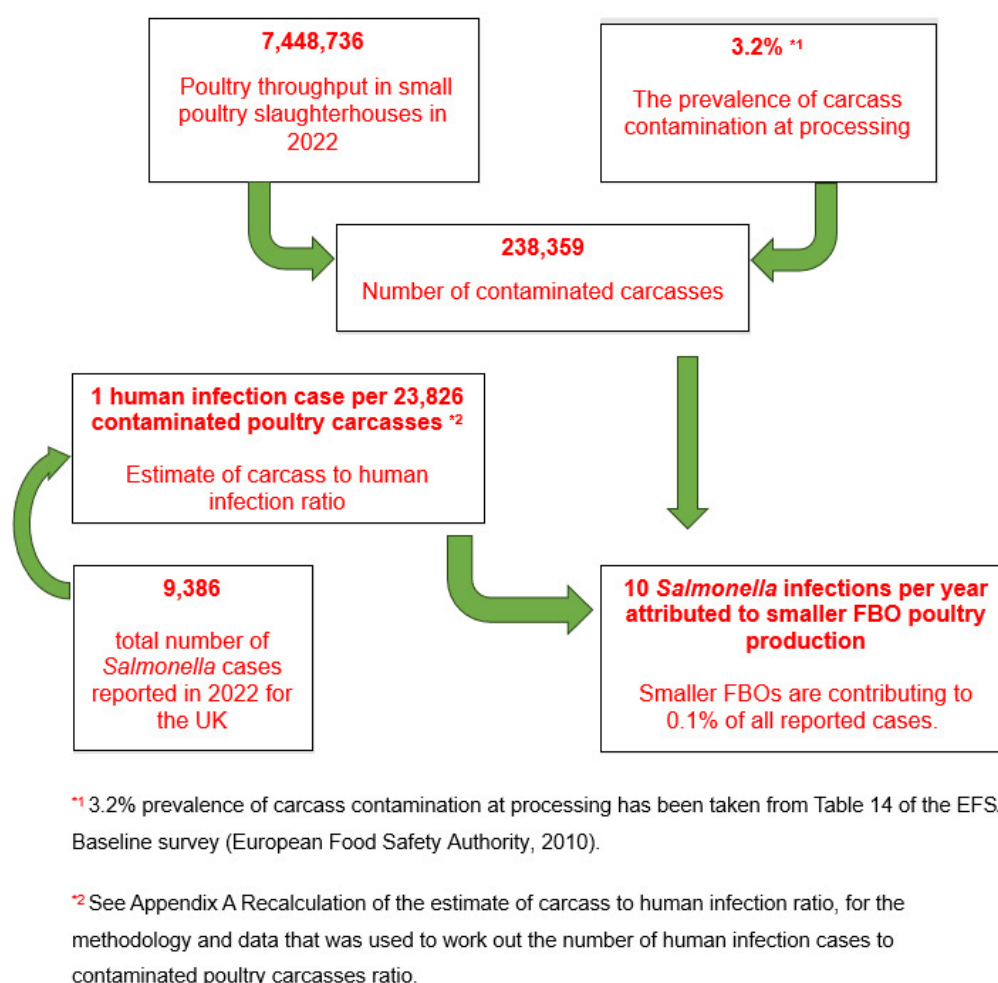


Figure 2. Calculation of the relative contribution of smaller FBOs to the UK's contamination rate of *Salmonella* infections, in 2022.

Review 13. What is the current total turkey production in the UK from small slaughterhouses?

Throughput data from 2022 does not specify the amount of turkey produced in UK (figures were added for both chicken and turkeys). In 2023, 15 out of the 17 slaughterhouses produce less than a million turkey per year and do not have to sample. Two FBOs, produced 7 million turkeys and makes up 80% of the total 8.7 million turkeys produced (2,302,120 and 4,872,679 respectively). These 2 FBOs are medium slaughterhouses producing only turkeys and are required to sample every 4 weeks. Also, according to NCP data, the estimated prevalence of regulated serovars in fattening turkey flock is 0.10% (2/2,017) in 2022.

Evidence from the original risk assessment that was reviewed.

"Thirty-two out of 34 FBOs produce less than a million turkeys per year and thus do not have to carry out MC sampling. Two FBOs, producing over 10m turkeys per year (80% of the total 13m), are required to sample every four weeks."

Summary

1. There has been no change to the established microbiological criteria for foodstuffs with which FBOs must comply to.
2. Comparing the SE and STM NCP testing in 2022 to the original risk assessment that used 2016 NCP data, chicken broiler flock prevalence increased to 0.02% (0.01% in 2016 to 0.03% in 2022) and turkey fattening flocks decreased by 0.16% (0.26% to 0.10%). Although there was an increase in prevalence in the broiler flock, it still falls below the EC target of a maximum of 1% flock prevalence of SE and STM (APHA, 2023). Based on this, the concluding statement in the original risk assessment *"Thus it is relatively straightforward to discount the need for MC sampling in smaller FBOs on the basis of FSC 1.28 alone"* is still valid.
3. The contribution of smaller abattoirs to total UK's poultry production still remains at approximately 1% compared from 2017/2018 to 2022. In a twelve-month period from 2017/2018 there were 41 smaller slaughterhouses that could potentially add an extra 9 million contaminated carcasses to the UK's carcass contamination prevalence. In 2022, this decreased to 26 smaller established with a potential to add an extra 7.5 million contaminated carcasses to the UK's carcass contamination prevalence.
4. Sampling frequencies for FBOs based on their size has not changed since the original risk assessment. Slaughterhouses with an annual throughput below 1,000,000 broilers or turkeys (less than 20,000 broilers/turkeys per week) are still exempt from *Salmonella* testing requirements.
5. BPC members still account for 80% of UK poultry production by total heads slaughtered, and most of the poultry produced in the UK that must undergo MC sampling. Micro testing results from BPC members from a twelve-month period from 2017/2018 were compared to 2023 results and showed a reduction in overall estimated

incidence of *Salmonella* by 0.53% (2% down to 1.47%), with no regulated serovars being detected in 2023 compared to a 0.1% detection result in 2017/2018.

6. With regards to the question "*Is the UK still meeting the performance objective (PO) of 2 to 5 % carcass prevalence for Salmonella, based on Process Hygiene Criteria 2.1.5 laid out in Regulation 2073/2005?*" This answer still remains yes. This is on the basis that carcass contamination rates still suggest a prevalence of 2 – 3% (with the EFSA Baseline survey (European Food Safety Authority, 2010) still being the most up-to-date baseline information available), the prevalence of regulated serovars of *Salmonella* well below the EU target of a maximum of 1% flock prevalence and there being no change to Process Hygiene Criteria or its testing.
7. The relative contribution of smaller FBOs to the UK's contamination rate of *Salmonella* infections from consuming domestic poultry is still small. In the original risk assessment, 1 infection case was attributed per 4,916 contaminated poultry carcasses, around 50 *Salmonella* infections per year. In 2022, this changed to 1 infection case per 15,544 contaminated poultry carcasses, around 10 *Salmonella* infections per year.
8. Total turkey production in the UK from small slaughterhouses has decreased with 2023 data showing 15 out of 17 FBOs producing less than a million turkeys per year, compared to 32 out of 34 from the time of the original risk assessment. There is a reduction of 3 million turkeys produced by the two FBOs that are required to sample every four weeks (10 million in 2019 to 7 million in 2023). Based on this, it can be concluded that the following statement in the original risk assessment is still valid. "*Even if all STM or SE positive flocks were from farms that send birds to smaller FBOs, it is unlikely that the flock prevalence for these farms would breach the EC target. Thus, we can conclude that the input to both larger and smaller FBOs is well below tolerable limits.*"

Discussion

Having reviewed the data presented in the original risk assessment, and refreshed this with more current available data, we conclude that:

- There has been no change to testing requirements as stated in retained EU legislation.
- There have been no significant changes to NCP data for the prevalence of the regulated serovars of *Salmonella*.
- There has been a reduction in the contribution of smaller abattoirs to total UK's poultry production.
 - The low prevalence of *Salmonella spp.* in live flocks and the decreasing number of human infections attributed to poultry products over recent years, suggests the maximum addition of 7.5 million to the carcass contamination prevalence may not be reflected in reality.
- There has been a small reduction in the overall estimated incidence of *Salmonella* by 0.53% for FBOs that are required to carry out micro testing.
- There has been a reduction in the estimated number of *Salmonella* infections from consuming domestic poultry meat, from around 50 infections per year at the time of the original risk assessment, to around 10 *Salmonella* infections per year in 2022, from smaller FBOs.

Combining these findings, it is deemed that there is no change to the conclusion of the original risk assessment that was carried out. The following conclusion statements have been taken directly from the original risk assessment:

"We conclude that the population risk from consuming poultry from smaller FBOs that do not conduct MC sampling should be considered tolerable. As allowed under EC Regulation 2073/2005, "slaughterhouses and establishments producing minced meat and meat preparations in small quantities may be exempted from these sampling frequencies".

"...there is no substantial change, so there is no reason to indicate that the original judgement not to sample smaller FBOs is now not valid."

Further recommendations

Due to the uncertainty regarding how the original risk assessment factored cutting plants into their exemption conclusion, and that this review has excluded cutting plants from its scope, a separate risk assessment may be required to look at the exemption of small cutting plants to test for *Salmonella*, based on their exemption criteria of less than 2 metric tonnes per week combined minced meat and meat preparations intended to be

eaten cooked, and the potential use of poultry meat that has been imported and not been through the testing that a UK slaughterhouse plant undertakes.

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Appendices

Appendix A. Recalculation of the estimate of carcass to human infection ratio

Appendix B of the 2019 report has been recalculated using 2022 data.

Data

1. 1,153,200,000 million / 1,153.2 billion of poultry (broilers, bowling fowl and turkeys) slaughtered in the UK in 2022 ([Latest poultry and poultry meat statistics](#)).
2. This produced 2,753,300 tonnes of poultry meat in 2022. *
* 2021 annual live weights for Turkeys were used due to the average turkey weight for 2022 being suppressed due to a low survey response rate. ([Latest poultry and poultry meat statistics](#)).
3. Of this volume, 253,792 tonnes were exported in 2022 ([Agriculture in the UK Dashboard](#)).
4. Leaving 2,499,508 tonnes to be domestically consumed - equivalent to around 1,046,837,420 birds, in 2022.
5. The number of laboratory-confirmed cases of *Salmonella* in
 - a. England 8125 [Lab confirmed cases of Salmonella – England](#)
 - b. Northern Ireland 171 [Lab confirmed cases of Salmonella – Northern Ireland](#)
 - c. Wales 408 [Lab confirmed cases of Salmonella – Wales](#)
 - d. Scotland 682 [Lab confirmed cases of Salmonella – Scotland](#)Giving a total of 9,386 cases.
6. According to (Gibbons et al., 2014) Under-reporting factor for *Salmonella* spp. is around 1.4 cases in the community for every 1 health event is that is reported to the appropriate public health body, in the UK.
7. 0.6% of *Salmonella* cases in the UK are attributable to broiler consumption. (No change to source data from 2019 report).

8. 10.1% of *Salmonella* cases in the UK are attributable to turkey consumption. (No change to source data from 2019 report).

Calculations

Calculation 1: $5) \times 6) \times [7)/10 + 8)/10] = \text{approximate number of cases attributable to domestic poultry consumption.}$

$9,386 \times 1.4 \times [0.006 + 0.101] \approx 1,406$ cases in 2022 attributable to domestic poultry consumption.

Calculation 2: $4) \times 3.2\%$ (*Salmonella* prevalence at processing) = ratio of contaminated carcasses.

$1,046,837,420 \times 3.2\% = 33,498,797$ contaminated carcasses

Calculation 3: Answer from Calculation 2 against [:] Answer from Calculation 1.

$33,498,797 : 1,406 = 23,826:1.$

23,826 contaminated carcasses to every 1 case attributable to domestic poultry meat consumption.

Appendix B. Summary of the evidence in the original risk assessment that has been updated

Review number	Statement in 2019 Risk Assessment	Page number in 2019 Risk Assessment	Review question formulated to present the updated data in this report
1.	As contamination levels across the EU fell, the acceptable number of <i>Salmonella</i> positives was reduced from 7 to 5 out of 50.	3	Has there been any change to the number of <i>Salmonella</i> positives which is acceptable in regulation?
2.	SE and STM represent around 1% of all <i>Salmonella</i> isolates from NCP testing.	3	Is the prevalence of <i>Salmonella</i> Enteritidis (SE) and <i>Salmonella</i> Typhimurium (STM) from National Control Programme (NCP) testing still below the EC target of 1% flock prevalence?

Review number	Statement in 2019 Risk Assessment	Page number in 2019 Risk Assessment	Review question formulated to present the updated data in this report
3.	Only 1% of UK poultry production does not fall under FSA's requirements for MC sampling.	4,	Do small abattoirs still contribute no more than 1% of the total UK's poultry production?
4.	Larger FBOs must sample weekly; however satisfactory results after 30 weeks allow them to only sample every two weeks. Medium-sized FBOs (slaughtering between 1 and 7.5 million turkeys or broilers per year) sample every four weeks (FSA 2018). Smaller FBOs (slaughtering less than 1 million birds per year) are not required to sample for <i>Salmonella</i> .	6	Have the sampling frequencies for Food Business Operators, based on their size, changed?
5.	STM and SE are rarely isolated from the NCP for <i>Salmonella</i> in broilers (APHA, 2017), and the 2016 incidence of these serotypes - 0.01% (5/36,505) in broiler flocks and 0.26% (6/2270) in fattening turkey flocks - was well below the EC target of 1% flock prevalence (EC Regulation 2160/2003). Thus, it is relatively straightforward to discount the need for MC sampling in smaller FBOs on the basis of FSC 1.28 alone.	11	Is the prevalence of <i>Salmonella</i> Enteritidis (SE) and <i>Salmonella</i> Typhimurium (STM) from National Control Programme (NCP) testing still below the EC target of 1% flock prevalence?
6.	British Poultry Council (BPC) members represent at least 80% of UK poultry production by total heads slaughtered, and most of the poultry produced in the UK that must undergo MC sampling. The companies that submitted results own fifteen slaughterhouses between them and all conduct MC sampling on a weekly basis.	15 and 16	Are at least 80% of UK poultry slaughterhouse operators still members of the British Poultry Council (BPC)?
7.	Table 2 : Summary of results from industry over 12-month period (Jun 2017 – Jun 2018).	16	Have micro testing results from BPC members changed since the original assessment?
8.	Given that 1. the carcass contamination rates suggest a prevalence in the region of 2-3%, 2. national flock prevalence is lower than in 2008 and is around the EU target of 1% flock prevalence, and 3. that the sensitivity Se of the pooled test is unlikely to be 100%, we suggest that the UK as a Member State is in all likelihood meeting the working PO of 2-5%.	16	Is the UK still meeting the performance objective (PO) of 2 to 5% carcass prevalence for <i>Salmonella</i> , based on Process Hygiene Criteria 2.1.5 laid out in Regulation 2073/2005?
9.	We assessed the contributions of smaller and larger FBOs by analysing FSA throughput data	18 and 19	Do small abattoirs still

Review number	Statement in 2019 Risk Assessment	Page number in 2019 Risk Assessment	Review question formulated to present the updated data in this report
	for all poultry slaughterhouses and cutting plants operating between June 2017 and May 2018....		contribute no more than 1% of the total UK's poultry production?
10.	Appendix B: Estimate of carcass to human infection ratio This is necessary to answer the following question in section 4.4 - on page 19 "What is the relative contribution of smaller and larger FBOs to the UK's contamination rate?"	19 and 39	What is the current relative contribution of smaller FBOs to the UK's contamination rate, using the same calculation from the original risk assessment?
11.	The latest 2016 results from the National Control Programme in broiler flocks isolated STM and SE from five flocks out of 36,505 tested (0.01%) (APHA, 2017).	23	Is the prevalence of <i>Salmonella</i> Enteritidis (SE) and <i>Salmonella</i> Typhimurium (STM) from National Control Programme (NCP) testing still below the EC target of 1% flock prevalence?
12.	In 2016, six fattening turkey flocks out of 2,270 tested (0.26%) were found positive for regulated serovars (APHA, 2017).	23	Is the prevalence of <i>Salmonella</i> Enteritidis (SE) and <i>Salmonella</i> Typhimurium (STM) from National Control Programme (NCP) testing still below the EC target of 1% flock prevalence?
13.	Thirty-two out of 34 FBOs produce less than a million turkeys per year and thus do not have to carry out MC sampling. Two FBOs, producing over 10m turkeys per year (80% of the total 13m), are required to sample every four weeks. Again regulated serovars contributed only a small proportion of the total <i>Salmonella</i> isolates (6 of 396 – 1.5%).	23	What is the current total turkey production in the UK from small slaughterhouses?