Annual Science Update from FSA's Chief Scientific Adviser

FSA 23-06-05 report by Professor Robin May, FSA Chief Scientific Adviser (CSA), this is the third annual report to the Board.

1. Introduction

1.1 This is my third annual report to the Board as the Food Standard Agency's Chief Scientific Adviser (CSA), and I welcome the opportunity to reflect on the last 12 months in the role.

2. Role of the FSA CSA

2.1 To recap, my role as the FSA CSA is essentially threefold:

a) to provide high level assurance about science within the FSA, offering independent challenge and advice to the Board, Executive and the organisation more widely.
b) to maintain strong links with CSAs in other government departments as well as key external stakeholders, representing FSA's interests in the wider (inter)national landscape and ensuring that the organisation benefits from the most up to date scientific findings from other fields.
c) to act as an ambassador and communicator of science both within the FSA and across government, industry and consumer groups.

3. Science Partnerships

3.1 A key theme of the last year has been our focus on building cross-governmental partnerships to pursue many of the science aims that address the ambition laid out in last year's FSA Strategy. A broad collaborative approach is not only better for science delivery but typically also delivers both improved value for money and a faster route to impact.

3.2 One such approach has been our involvement alongside other government departments (Department for Environment, Food and Rural Affairs, Department of Health and Social Care, Department for Education and Department for Levelling Up, Housing and Communities) as a partner in a new 3-year programme of work funded by the Economic and Social Research Council to understand which interventions in the food system can effectively encourage and enable people to have healthier and more sustainable diets. This programme, termed **SALIENT**, consists of a series of randomised controlled trials (RCTs) in the English food system. The first tranche of 5 trials will commence in July 2023, with a second tranche of a further 5 trials in April / June 2024 and the project as a whole concluding in spring 2025. I look forward to seeing the outputs from this work and discussing with the Board in due course how the FSA may consider acting on those findings.

3.3 The FSA-led programme PATH-SAFE (Pathogen Surveillance in Agriculture, Food and Environment) is now entering its final year of funding. After an initially slow start due to funding and administrative complications, I have been delighted this year to see the pace of delivery and the very important insights that this programme is delivering. Projects within PATH-SAFE range from monitoring antimicrobial resistance in wastewater, livestock and animal feed, through to construction of a user-friendly database that will coordinate pathogen genomic and epidemiological data across a very wide range of organisations. The programme has started a series of public webinars on findings and will be holding a programme conference later this year.

3.4 In my view, PATH-SAFE is an exemplar of the kind of multi-sector applied research programme that government is uniquely placed to lead on. The ultimate impact of this programme extends far beyond FSA, and I recognise that the size and resource available is a major limitation in our ability to build on findings emerging from the programme around the epidemiology and environmental distribution of foodborne pathogens. Nonetheless, I recommend that FSA engages closely with other departments and wider stakeholders to a) ensure successful aspects of PATH-SAFE have a clear 'legacy plan' to guarantee long-term success beyond the current funding period and b) to start to consider how such modern, evidence-based approaches can best be implemented into statutory controls in due course (for instance, in import sampling or on-farm surveillance).

3.5 In recent weeks, the Science Council have completed Working Group 6 (WG6), a wide-ranging consideration of the potential food safety implications of changes in the agri-food system aimed at moving towards net zero carbon emissions. This project has drawn together expertise from industry, academia and other government departments and highlights a number of areas where the Council suggests FSA should focus attention over the coming years. The WG6 report is linked here for the Board's consideration and will also be presented to the FSA Executive in the coming weeks and help guide our future thinking, particularly in the context of our strategic aim to ensure that food is "healthy and sustainable".

3.6 The last year has also provided well-earned recognition for the FSA's innovative study Kitchen Life 2, which won the 'Analysis in Government Innovation Award' in 2022 and was shortlisted for 'Best Use of Data and Technology' at the prestigious Civil Service Awards. This ethnographic study uses motion-sensitive cameras in domestic and commercial kitchens to observe real-life food safety behaviour as well as passive measurements (such as fridge/freezer thermometers). Surveys and interviews to add further context to the observed footage, with findings from this study to be published this month. I look forward to seeing how these findings help inform our own risk analysis process for consumers and businesses.

4. Regulation for Innovation

4.1 During the autumn fiscal statement, the Chancellor announced a GCSA (Government Chief Scientific Adviser) review of opportunities for **regulatory reform to support innovation.** This review is complementary to the FSA's own review of regulatory reform opportunities, and we engaged closely with the GCSA-led team to identify a number of areas that - with suitable additional resource - could potentially be reformed to help support innovation within the food sector. I was pleased to see that the final report included a direct recommendation to provide additional resource to FSA, as well as highlighting a number of broader areas (such as enhanced collaborative working between different regulators) that also present strong opportunities for us. However, it was disappointing to see that no immediate additional resource was being made available (rather, FSA has been encouraged to bid for additional funding to cover this area at the next Spending Review). This will inevitably mean a delay in many of the more ambitious and productive areas of reform that we have been considering, but nonetheless I hope that FSA will be in a strong position to carry out this work in the longer term once funding has been secured.

5. Science Capability Update

5.1 The cross-Government Science Capability Review highlighted a number of priorities for departmental science functions. In addition, there have been a number of changes within the organisational structure of Science, Evidence and Research Directorate (SERD) this year, as well as the more general need for prioritisation in response to centrally-imposed resource constraints, which the Board has previously considered. I was therefore pleased that the FSA undertook a **review of the organisation's science and evidence system** earlier this year. This review provides both enhanced visibility within FSA of science functions across the organisation and allows rapid identification of potential gaps in expertise (such as those resulting from staff turnover). We also published renewed **Areas of Research Interest** this year, which are an extremely useful vehicle for highlighting our priority science themes to other government departments and the external research community. Overall, I remain confident that the FSA science base remains strong and is able to deliver on its statutory role in areas such as risk assessment and product authorisations.

5.2 However, I am concerned that the overall **resource constraints** that have been imposed on the organisation severely limit its ability to be 'future-proof'. As CSA, I have been closely involved in Executive prioritisation decisions that arise from additional FSA commitments around the Retained EU Law Bill, Windsor Framework and other competing cross-Government pressures and support them without reservation – the FSA's commitment to food safety and authenticity is non-negotiable and it is entirely right that areas such as regulatory compliance and incident response are prioritised. However, the knock-on implication of this is that there is very little resource available to invest in areas such as externally commissioned research projects, recruitment of staff with expertise in emerging areas of science, or international 'horizon scanning' of early-stage developments in the food system. As one example, the Strategic Evidence Fund (flexible funding, which is used for small-scale, rapid research projects in fast-moving areas) will have no additional budget this year beyond existing commitments. Consequently, we retain very little capacity to commission 'short, sharp' research projects in areas of future importance. One way to partially address this gap is to work closely with other government departments and external organisations to 'combine forces', and several of the initiatives described elsewhere in this report are testament to the colleagues who have worked hard to build these collaborative relationships. Nonetheless, it is my view that a science-led, responsive regulator such as FSA should have a substantial science base dedicated to more exploratory, future-facing evidence gathering. I very much hope that future spending review allocations will recognise this and enable the FSA to increase capability in this area.

5.3 In **Northern Ireland, a specific Science and Surveillance team** was established in September 2022 to address the additional science requirements associated with unique regulatory environment. The team have assumed responsibility for additional work in relation to Northern Ireland National Reference Laboratories and for additional sampling and surveillance duties such as EU monitoring and reporting of Antimicrobial Resistance in retail meats. The team also have a remit for nutrition science, capturing and monitoring data on what Northern Ireland consumers, eat, purchase and their behaviours and attitudes towards food related issues. The team act as government observers on SACN (Scientific Advisory Committee on Nutrition) and conduct research in partnership with other organisations to inform dietary health policy in Northern Ireland.

6. Sampling and Surveillance

6.1 In last year's report, I highlighted my concerns about the long-standing reduction in the UK's official **laboratory capability**, particularly in regard to food sampling and surveillance. At the time, I mentioned that the FSA were developing plans to provide short-term funding to areas such as official control laboratories and public analysts in order to help address pressing areas of

concern. I have been pleased to see the success of these interventions over the last twelve months. For instance, through providing grant funding for metals analysis, GMO and allergens to laboratories. We have also worked closely with key partner organisations, such as Fera Science, to support their bids to build capacity; for instance, in successfully obtaining £775k of independent funding from BEIS for the purchase of advanced analytical instrumentation for food safety testing.

6.2 However, it is an ongoing cause for concern that the broader UK infrastructure for sampling and surveillance remains underinvested and fragmented. Current funding models do not incentivise regular sampling and reporting, whilst the involvement of multiple agencies (with multiple IT systems) make rapid and transparent data-sharing difficult. The FSA is playing a major part in trying to address some of these shortcomings – for instance, with the multi-platform pathogen database system that is being developed through PATH-SAFE – but this is not an 'FSA problem' to solve, but rather an area of national importance and involving multiple government departments.

6.3 Two recent developments in which FSA has been closely involved give me cause for cautious optimism for improved sampling and surveillance in the future. Firstly, the Government has recently published its **Borders Target Operating Model,** which the Board has previously considered in detail. As this new system for import controls develops, there is an opportunity for a much more integrated approach to monitoring of food movements in and out of the UK, along with the prospect of a versatile, transparent system of data sharing. I very much hope the departments leading on this work will grasp the opportunity to capitalise on this new approach to import controls.

6.4 Secondly, the refresh of the **UK Biological Security Strategy,** and the scoping work around a National Biosurveillance Network that is encompassed within it, represents an opportunity for the UK to develop world-leading infrastructure to monitor and prevent disease outbreaks. Food and feed monitoring is a key part of biosurveillance and so it is good to see the close involvement of FSA colleagues in this activity. I hope in due course that it will provide a great opportunity to address FSA priorities around ensuring the safety and authenticity of food, whilst at the same time enabling us to play our part in national biosecurity.

7. Incidents

7.1 As ever, the last year has seen the FSA handle a large number of food and feed incidents. Several of these have had wide-reaching impact and raised key science questions in which I have been involved. These include:

a) Our response to, and revised advice in light of, a cluster of **Listeria** infections arising from smoked fish consumption.
b) The ongoing issues around infections with **Salmonella** Mbandaka, now traced to imported chicken from Ukraine.
c) An incident of **lead contamination** in commercial breast milk.

7.2 In recent months we have also fed in closely to the Defra-led work around large-scale **crustacean die-offs** on the north coast in order to assess any potentially enhanced risks to humans and ensure these are accurately communicated to the public.

7.3 Finally, we joined other government departments in a three-day exercise to test **emergency plans** in the event of a national power outage. A number of recommendations arising from this exercise are being fed back centrally (for instance, around communications support in the event of a loss of power).

7.4 In all three of our incident responses, I was pleased to see how rapidly colleagues across the organisation could reorient activities to tackle the immediate need, and to see how critical scientific evidence is to the rapid decision making that is essential in fast-moving incidents. However, in my view these diverse challenges also highlighted two important areas for attention.

7.5 Firstly, the quality and confidence of the risk advice we can give is directly related to the **quality of the underlying science**. A confident assessment of microbiological or toxicological risks in an incident depends on detailed understanding of the pathogen's epidemiology or metabolism of the toxin. I therefore view a consistent, forward-looking programme of evidence gathering as critical to FSA's mission.

7.6 Secondly, it is my view that we need to develop a more **robust approach to 'extreme incidents'.** FSA is well-versed, and extremely skilled, in providing rapid advice during relatively small incidents such as isolated disease outbreaks. However, in common with many organisations, we are less skilled in considering highly-unlikely but extreme national-scale incidents – for instance, in considering what advice we would give about eating 'risky' foods in the face of life-threatening food shortages. Over the coming months, I will be working closely with our own incidents team and wider cross-Government colleagues to help develop such guidance so that FSA is able to provide high-quality risk advice even in the most extreme of circumstances.

8. Precision Breeding

8.1 As the Board is aware, we have been closely involved in the Defra-led work around the Precision Breeding Act. I gave evidence at the Public Bill hearing last year and joined Professor Gideon Henderson (Defra CSA) at a House of Lords engagement session led by Lord Benyon. I have also been closely involved in a number of discussions on this topic with industry stakeholders, civil society groups and bodies such as the Regulatory Horizons Council, to ensure that the FSA position accurately reflects the breadth of public feeling on this issue. Throughout the process, I have been deeply impressed with the expertise and professionalism of both FSA colleagues and independent members of our advisory committees, who have often had to wrestle with complex topics under tight timelines. This remains a fast-moving, high priority area, though, so the development of a strong, evidence-based authorisation pathway is a critical priority for the coming months.

9. Fact-finding visits

9.1 After the limitations of previous years imposed by the pandemic, it has been a pleasure this year to be able to undertake a number of visits around the UK and internationally to attend meetings, give talks and most importantly to hear about scientific developments in the food sector. A full list of these engagements is given at the end of this report, but I would like in particular to highlight the invaluable insights that we have received from many organisations around **food and feed innovation**. Such areas include sectors such as cultivated agriculture, insect-based foods, novel animal feed and genome-edited crops. Being able to see products under early stages of development and to talk to the teams behind their creation is of enormous benefit in helping shape our future approach to areas such as Regulated Product authorisations. I am deeply indebted to all those in the organisations that I have visited who took time out of their busy schedules to conduct tours, provide demonstrations and answer questions.

10. Scientific Advisory Committee Reviews

10.1 All Governmental Scientific Advisory Committees are externally reviewed on a periodic basis. Since our Advisory Committee on Social Sciences (ACSS) and our Science Council (SC) are newer committees that have not previously been reviewed, at the end of 2022 we

commissioned an **in-depth independent review** of both. The purpose of these reviews is to provide assurance to the FSA, and its stakeholders, that these committees' roles and purposes are appropriate in addressing the future needs of the FSA, consumers and wider government, and that the bodies are operating effectively and efficiently.

10.2 I appointed Professor Sir Charles Godfray and Professor Annette Boaz to act as independent assessors and produce the report and recommendations. I am extremely grateful to both for the detailed, thoughtful way they approached the review and for the carefully considered recommendations that they have made. The report produced **15 recommendations** covering ways of working, composition and efficiencies for both Committees. These have been considered by the Committees themselves and by the FSA Executive, which is essentially recommending acceptance of all 15 recommendations.

10.3 The final report and the recommendations are being presented to the Board for their consideration today, alongside the FSA statement of response, setting out the plan for the future of the SC and ACSS. I have been closely involved in both the review process and the response to it and have full confidence that the proposed approach will continue to capitalise on the superb work of these Committees whilst introducing a number of improvements in process. **We are therefore seeking the Board's agreement to these proposals here.**

11. Research Partnerships and Fellowships

11.1 FSA's commitment to science and evidence puts us in a strong position to partner with external researchers to forge lasting partnerships. I have previously reported to the Board that I felt there were opportunities for FSA to participate in more such partnerships (often harnessing external funding to do so) and so I am very happy to report that this year has seen several such new collaborations take place.

11.2 As a partner in the 'Transforming UK Food Systems' programme, I was delighted to attend their **Early Career Conference** in December and hear about the diverse and exciting research programmes that are underway.

11.3 Closer to home, I have been delighted to see FSA welcome two independent researchers on secondment:
a) **Professor Tom Richards**, Professor of Evolutionary Genomics at the University of Oxford, who has been working with our Precision Breeding team, providing expert insight into the science behind genomic technologies.
b) **Dr Mariela de Amstalden**, Assistant Professor in Intellectual Property and Innovation at the University of Birmingham, has recently joined the Regulated Products team to consider the regulatory implications of food innovation, particularly in areas such as cultivated agriculture.

11.4 In my view, such partnerships offer benefits far beyond their immediate outputs, particularly in engaging with the wider research community and facilitating exchange of ideas between academia and government. I hope that FSA will continue to actively seek such partnerships and look forward to doing whatever I can to help facilitate them.

12. Science Communication

12.1 This year there have been a number of initiatives within SERD to ensure wider **visibility of FSA science**. These include active engagement with external science-focused events, such as British Science Week (in which we produced a number of web-based 'science highlight' pieces), and our participation in major science events such as the Microbiology Society annual conference or Civil Service Faststream seminars. 2022 also saw the launch of our Science Bulletin, with a primary focus on informing science stakeholders of opportunities, upcoming items of interest and

publications. This publication gained 969 subscribers when it launched in September 2022 and now has almost double that number. We continue to monitor usage metrics (for instance, 'clicks through' to other content) to refine and optimise our science messaging through this bulletin.

13. Future Priorities

13.1 I have highlighted a number of areas throughout this report which represent science priorities for the coming year. In addition, however, there are a number of overarching topics that I view as being high priority for the next 12 months and beyond:

- **Regulatory reform to support societal goals.** At present, our assessment of most regulated products, and novel foods in particular, focuses almost entirely on risk. However, new products can also bring benefits, for instance, in tackling health or sustainability issues. As we consider in detail how to reform our regulatory authorisation pathway, I am keen to ensure that the science of both risk and benefit is fully integrated into a new authorisation system in due course.
- **Integrated data systems.** Data-sharing is critical to good science advice, but often 'real-world' barriers create problems. PATH-SAFE is an excellent example of how a collaborative approach to data is more than the sum of its parts, but there is more that we, and others, can do. Over the next 12 months I am keen to identify and capitalise on opportunities to build larger, more user-friendly approaches to sharing data between healthcare, regulators, industry and others in order to maximise our evidence base for providing public health advice.
- **Sampling and surveillance infrastructure.** I have highlighted above my ongoing concerns about UK surveillance capacity in the food system. Whilst large-scale laboratory infrastructure development is a long-term prospect, the next 12 months will present opportunities for major progress in this area through initiatives such as the National Biosurveillance Network, and a priority for me will be to ensure FSA needs are highlighted in those discussions.
- **Wider health and sustainability objectives.** As mentioned elsewhere in this report, much of our proposed work around long term 'health and sustainability' objectives has had to be paused as a result of financial reprioritisation. This makes taking a more collaborative, innovative approach to delivering these aims even more important and this is an area where, as an independent CSA, I hope to be able to play an important role over the next year and beyond. In particular, there are key areas such as ecolabelling, the implications of the Environmental Land Management System for food, welfare improvements in animal husbandry and slaughter, or innovative products at the food/medicines interface, where science is central. My aim for the coming year is to work as closely as possible with other government departments and relevant stakeholders to push for progress in these areas in which FSA cannot act alone.

14. Summary

14.1 As I reach the end of my third year as CSA, I remain very confident in the FSA's strong science focus and the commitment of the teams who deliver it. In particular, the strong collaborative and supportive environment of the organisation and its willingness and ability to 'pivot' swiftly to new areas of importance are major strengths in a fast-moving food system. My two greatest concerns for the future are around **resourcing** and **skills**. Firstly, whilst I fully recognise the need to prioritise statutory functions in a resource-constrained budgetary environment, I remain deeply concerned that this will inevitably erode the FSA's capacity to undertake future-facing work; for instance, in areas such as regulatory reform or pathogen surveillance. I very much hope that future Spending Review awards will recognise the critical importance of these activities and provide resource to restore and enhance this function within

FSA. Secondly, the recruitment of highly skilled scientists, analysts, technologists and others to the organisation remains challenging, particularly in light of inflationary changes in the cost of living. This problem is far from unique to FSA and therefore I remain hopeful that reinvigorated activity within the Government Science and Engineering profession as well as a strong recognition in wider government as to the importance of science within policy making will help achieve the changes necessary to improve recruitment and retention of skilled experts to government.

Annex 1 - List of engagements

Table 1 Speaking Events

Date	Title	Organisation
09/06/2022	WFAC Annual Business Meeting	Welsh Food Advisory Committee (WFAC)
28/06/2022	Precision Breeding Oral Evidence Session	Genetic Technology (Precision Breeding) Public Bill Committee – House of Commons
28/06/2022	CIEH Food Safety Conference	Chartered Institute of Environmental Health (CIEH)
14/07/2022	Novel Proteins Industry Event	FSA
10/08/2022	Radio 4 Interview on Aspartame	BBC
20/10/2022	Citizen science for policy and practise - Keynote	UKRI
08/11/2022	Genetic Technology (Precision Breeding) Bill Teach-in	House of Lords
16/11/2022	Changing Food Landscape: UKAFP Annual Conference	UK Association for Food Protection

Table 2 – Site Visits

Date	Site Visit
08/07/2023	CEFAS in Weymouth alongside the Government Chief Scientific Adviser Sir Patrick Vallance
19/09/2023	Wageningen University and Research - Food Sciences and Technology in the Netherlands
08/11/2023	All-CSA away day – Leicester Space Park
24/04/2023	Food and Drink Expo – Foodex/Ingredients Show – NEC Birmingham
04/05/2023	Food Accelerator – Sheffield Olympic Legacy Park
05/05/2023	GLW Feeds - Shepshed
11/05/2023	Balmoral Show – Northern Ireland
24/05/2023	Ynsect – Visit to insect protein production facilities in France (Amiens and Dole)

Annex 2 – Metrics for British Science Week

Page	Page views	Unique page views	Average time on page
Robin May blog - British Science Week 2023 and connections across Government	55	49	00:03:02

Content	Platform	URL	Total impressions	Total shares	Total likes	Post clicks	Total Engagements (shares, likes and clicks)

The FSA is celebrating British Science Week! This year's theme is 'connections', and we are kicking things off with our Chief Scientific Advisor, @RobinMay9, discussing how he connects us to other Government departments.#BSW23 #FSAScience https://t.co/OjZ8XdaZVE	Twitter	Twitter	3080	6	11		62
British Science Week is a 10-day celebration of science, technology, engineering and maths. Each year has a different theme, with this year's being 'connections'. The FSA has a packed agenda for the week ahead focussing on our people, our work, the connections we make and how you can connect with us! We are kicking things off with our Chief Scientific Advisor, Professor Robin May, discussing how he connects us to other Government departments.#BSW23 #FSAScience	LinkedIn	LinkedIn	2638	8	38	21	67

Annex 3 - PATH-SAFE Status Update

PATH-SAFE

PATH-SAFE is a £19.2 million Shared Outcomes Fund (SOF) research programme which aims to develop a national surveillance network, using the latest DNA-sequencing technology and environmental sampling to improve the detection, and tracking of foodborne human pathogens and antimicrobial resistance (AMR) through the whole agri-food system from farm-to-fork. The heart of this 'virtual' network will be a new data platform that will permit the analysis, storage and sharing of pathogen sequence and source data, collected from multiple locations across the UK by diverse government and public organisations (including FSA, FSS, DHSC, Defra and others across the devolved administrations). This single, user-friendly data system will enable rapid identification and tracking of foodborne pathogens and AMR, improving public health, and minimising the economic and environmental impact of outbreaks. The programme experienced delays in 2021, but planning begun in earnest in early 2022, with key delivery now underway to complete in March 2024.

Status update:

WS	Activity	Partners include	Status April 2023

1a	Establish a curated, national foodborne disease genomic data platform	FSA, Digital Epidemiology Services, University of Oxford, University of Warwick, CLIMB Big Data	The creation of the WS1a data platform is in progress. The system specification is under development; it will initially be based on requirements gathered from end users during the discovery phase and will be enhanced through further engagement with the WS1a end-user group. Initial engagement with the consortium advisory groups (made up of subject matter experts that will also contribute to system development) has taken place, with the first meeting expected to take place in the coming weeks.
1b	Focused on E. coli (generic and STEC) and aims to use WGS to understand source attribution, infection threat, and the level of anti-microbial resistance (AMR) of E. coli isolated from a range of different reservoirs in Scotland.	FSS, Cefas, SEPA, Moredun, Scotland's Rural College (SRUC), MicrobesNG, Public Health Scotland, Scottish E. coli Reference Laboratory, Scottish Salmonella, Shigella and Clostridium difficile reference laboratory (SSSCDRL).	Sampling across the project remains ongoing. Isolation of E.coli from samples collected continues as planned, as well as data analysis. Isolates extracted from shellfish, abattoir animals, cattle, sheep, geese, wastewater, food and private water supply samples and are currently undergoing sequencing. Genomic analyses to identify protein variants for 1700 isolates has been completed as part of the host attribution models work.
2a	Focusing on Foodborne disease (FBD) in the agri-food environment: • appraise current surveillance systems by identifying existing environmental data and sampling infrastructure for the detection of FBD pathogens. • explore whether novel analysis technologies (for example WGS of pathogens from wastewater and shellfish) can improve the accuracy, speed and efficiency of outbreak detection and associated risks. • use high resolution pilot studies (including wastewater and shellfish sampling) at the river catchment scale to determine the feasibility of scaling up to an improved national surveillance infrastructure. • some of this work will build on existing networks and infrastructure, such as that already in place for water sampling, including recent UK-wide COVID-19 testing initiatives, as well as new approaches.	Defra, Cefas, Bangor University, Arup, Welsh Water, Public Health Wales	In the Taw-Torridge catchment pilot the winter sampling period is drawing to a close with the wastewater, river water and shellfish samples collect now being analysed and informing the sampling plan for the summer sampling period. Ribble Rivers Trust have been contracted to produce a summary report/review on sub-catchment level pathogen data and local knowledge available for the Ribble, to facilitate assessment of pathogen sources and pathways relevant to PATH-SAFE. Wastewater sampling and analysis have continued at the North Wales catchment pilot site, with 150 influent and effluent sample having now been collected. Norovirus quantification in UKHSA COVID-19 archived wastewater samples completed by the Environment Agency, with norovirus sequencing method being finalised at Cefas and sequencing to begin soon. Bacteriology work has now started at the Scottish Public Analyst labs for the Scottish wastewater Salmonella pilot study.
2b	Focusing on antimicrobial resistance (AMR) surveillance in the agri-food environment, a number of projects will support this work: • Characterisation of AMR E. coli from raw meat to identify resistance genes and circulating plasmids. • AMR surveillance sheep abattoir survey, including abattoirs AMR wastewater surveillance pilot. • AMR surveillance in cattle abattoir survey. • Survey of AMR and bacteria in bulk milk samples from dairy herds across Great Britain (GB). • AMR in imported animal feed. • AMR in imported raw pet food discovery work (scoping).	Defra, VMD, APHA, Cefas, National Milk Laboratories (NML), FSA, Welsh Government, AFBI, Scotland's Rural College (SRUC).	Sequencing of the raw meat E. coli isolates is now complete and AMR genotypes and MLST established for all successfully sequenced isolates. Sample collection is progressing as planned on the sheep survey project, milk project and animal feed project (raw ingredients and finished feed). Initial bacteriology results are following expected trends. Cattle survey has successfully completed the first stage (piloting methods and survey design), with all involved partners agreeing that the project should progress into stage 2 (conducting a UK wide survey). On the raw pet food project, plans have been made for further engagement with UK Pet Food (PFMA) to explore possible opportunities to engage directly with industry.

2c	Utilise the infrastructure developed for NI SARS-CoV-2 wastewater surveillance programme and undertake building level wastewater monitoring to investigate prevalence of a foodborne disease, norovirus, and antimicrobial resistance within the NI care home setting.	DAERA, Queen's University Belfast, Department of Health (Northern Ireland), Public Health Agency (Northern Ireland), Northern Ireland Environment Agency, Department for Infrastructure (Northern Ireland), Northern Ireland Water	Protocol and methodology development/optimisation underway (Norovirus, AMR and spread within care home tracing), including optimization of multiplex RT-qPCR assay for the detection of Norovirus complete, sequencing from a pure culture obtained from wastewater samples complete and isolates captured and confirmed for purity and RADIAN-ASAP instrument has been installed. Sequencing of wastewater samples positive for Norovirus GI and GII has been carried out and result pending. Questionnaire has been developed and practice interviews are ongoing. Collection of Influent and effluent samples from wastewater treatment plant ongoing and care home sampling to be initiated by the end of April, following ethical approval.
2d	Utilise existing sample sets and data to investigate source and transmission dynamics of food borne disease (FBD) caused by Campylobacter, including investigation of the spread of antimicrobial resistance (AMR) through Agri-Food systems.	FSA/University of Oxford	Upon completion of the contract last month, delivery began at pace. DNA extractions have taken place and samples have been sent for sequencing. Further samples will be sent for sequencing in the coming weeks. The delivery team are liaising with colleagues across the UK to organise access to agri-food isolates.
2e	Whole Genome Sequencing of historical Salmonella isolates, to generate background data on the genomic diversity of foodborne pathogens in the UK.	FSA/AFBI	Between mid-February and mid-March AFBI successfully processed 100 historical Salmonella isolates (culture, extraction and sequencing), and uploaded the sequences to Enterobase. PATH-SAFE has been noted in comment field on uploaded sequences in Enterobase to allow identification. This project is now complete.
3a	Rapid, in-field diagnostic technologies - Investigate the technology readiness levels (TRLs) of in-field FBD and AMR diagnostic technologies. This includes horizon scanning, stage of development and end-user needs. The results of these investigations will inform options for the next stages of in-field testing. The co-design of applications with end-users will be critical to ensure real-world applicability.	FSA, Fera, University of Lincoln	Database of technologies identified from horizon scanning, TRL framework and stakeholder map and database have been finalised. The project has now progressed to working on the next two deliverables: a database of technologies with TRL scores using assessment questions developed during a full text review of 2600+ papers. An evaluation matrix per stakeholder group will be developed via a series of stakeholder and end user workshops happening in April.
3b	Rapid, in-field diagnostic technologies - to repurpose rapid, in-field wastewater diagnostic technology that was developed in response to the COVID-19 pandemic for detection of FBD.	UKHSA, 20/30 Labs	20/30 Labs have completed the proof of concept and optimisation work on utilising LAMP on 7 target pathogens - Salmonella spp., Listeria monocytogenes, Norovirus, adenovirus, astrovirus, rotavirus and sapovirus. This project is now complete.
4	Environment AMR surveillance system pilot	EA, VMD, Defra, UKHSA, Deloitte, Quadram Institute, Aecom, Cranfield University, University of Exeter, UK Centre for Ecology and Hydrology	Most R&D projects are now complete, and reports are under review by the team. One final project is expected to complete in Q1 FY23/24. Development of the exemplar AMR Environmental Surveillance System is now complete; the system is in the live validation and improvement phase. Discovery work for a future AMR One Health Surveillance System is also nearing completion, with the draft business cases under review at present by the team.

Programme	Evaluation, fellowships, communications, governance	FSA, RAND Europe	Evaluation partner, RAND Europe, was appointed in November 2022. Theory of change, M&E framework and process/impact evaluation plans delivered. Fellowships in post. Comms strategy developed and regular communications underway (e.g., quarterly newsletters, monthly webpage updates, taking part in national campaigns, e.g., British Science Week). Communities of interest have been established – wastewater and bioinformatics. Governance structures in place and utilised monthly/quarterly as needed.

Annex 4a: Review of the Food Standards Agency's Science Council and Advisory Committee for the Social Sciences

Annex 4a has been published on a separate web page, read the full paper: Review of the Food Standards Agency's Science Council and Advisory Committee for the Social Sciences.

Annex 4b: FSA Response to Public Body Reviews 2022 to 2023

Annex 4b has been published on a separate web page, read the full paper: Annex 4b FSA Response to Public Body Reviews 2022 to 2023