CONTRACT FOR THE PROVISION OF:

Burden of Antimicrobial Resistance Genes in Selected Ready-to-Eat Foods

Reference Number: FS301050

This document forms the contract for the Services between;

Food Standards Agency ("Client") having its main or registered office at Clive House, 70 Petty France, London SW1H 9EX

and

Fera Science Ltd ("Supplier"), Sand Hutton, York, YO41 1LZ

to be effective from 4th February 2019 until 28th February 2021
unless varied by extension.

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WHEREAS

The Food Standards Agency has selected the Supplier to act as a Supplier in the performance of activities connected with the Project described on the title page of this contract, for The Food Standards Agency, the Supplier shall undertake to provide the same on the terms and conditions as set out in this Contract.

Unless and until directed otherwise, nothing in this Contract, shall be construed as giving a guarantee of any remunerative work whatsoever unless or until such work is requested and confirmed by means of a duly authorised Purchase Order.

CROWN REPRESENTATIVES

Where any supplier has been adjudged to fall under the auspices of a "Crown Representative" then any resultant terms and conditions will be subject to, where appropriate, any central contracts and/or negotiation or procurement processes involving such suppliers.

IT IS AGREED AS FOLLOWS:

1. TERMS and CONDITIONS

1.1 As used in this Contract:

a) the terms and expressions set out in Schedule 1 shall have the meanings set out therein;

b) the masculine includes the feminine and the neuter;

c) the singular includes the plural and vice versa; and

d) the words "include", "includes" and "including" are to be construed as if they were immediately followed by the words "without limitation".

1.2. A reference to any statute, enactment, order, regulation or other similar instrument shall be construed as a reference to the statute, enactment, order, regulation or instrument as amended by any subsequent statute, enactment, order, regulation or instrument or as contained in any subsequent re-enactment thereof.

1.3. A reference to any document other than as specified in Clause 1.2 shall be construed as a reference to the document as at the date of execution of this Contract.

1.4. Headings are included in this Contract for ease of reference only and shall not affect the interpretation or construction of this Contract.

1.5. References to "Clauses" and "Schedules" are, unless otherwise provided, references to the Clauses of and Schedules to this Contract.

1.6. Terms or expressions contained in this Contract which are capitalised but which do not have an interpretation in Schedule 1 shall be interpreted in accordance with the common interpretation within the legal services market where appropriate. Otherwise they shall be interpreted in accordance with the dictionary meaning.

1.7. In the event and to the extent only of any conflict or inconsistency in the provisions of the Clauses of this Contract and the provisions of the Schedules, the following order of precedence shall prevail:

a) the duly authorised Client Purchase Order;

b) the Schedules; and

c) this Contract

2. THE SERVICES

2.1. This Contract shall govern the overall relationship of the Supplier and the Client with respect to the provision of the Ordered Services.

2.2. The Supplier shall provide the Ordered Services and meet its responsibilities and obligations hereunder in accordance with the provisions of Schedule 2 (Ordered Services) and Schedule 3 (Specific Obligations).

2.3. Notwithstanding clause 2.1, the Supplier shall perform the Ordered Services to the agreed satisfaction of the Client's Representative.

2.4. The Supplier shall notify the Client as soon as it becomes aware of an event occurring or which it believes is likely to occur which will cause material delay to or materially impede the performance of any Ordered Services or any part thereof and the Supplier shall take all necessary steps consistent with good practice to obviate and/or minimise the delay to the Client.

2.5. In the event that the Supplier fails due to its Default to fulfill an obligation by the date specified in any Purchase Order for such fulfillment, the Supplier shall, at the request of the Client and without prejudice to the Client's other rights and remedies, arrange all such additional resources as are necessary to either obviate the delay or to fulfill the said obligation as early as practicable thereafter, at no additional charge to the Client.

2.6. In the event that any obligation of the Supplier specified in the Contract is delayed as a result of a Default by the Client, then:

a) The date associated with the relevant obligation(s) as specified in the Purchase Order (and the dates similarly associated with any subsequent obligations specified in the Purchase Order) shall be amended by a period of time equal to the period of such Client Default (or such other period as the parties agree in writing); and

b) Both parties shall use all reasonable endeavors to obviate and/or mitigate the impact of such delay and to recover any resultant delay to the performance of the Ordered Services.

2.7. Nothing in this document, or any Purchase Order, shall have the effect of making the Supplier or any of the Supplier's other employees or agents, the employee of the Client.

2.8. Nothing in this document or any Purchase Order shall constitute the parties as partners of each other.

3. STANDARDS AND REGULATIONS

3.1. The Supplier shall at all times comply with the Health and Safety provisions, security requirements and personal conduct obligations, of any premises visited and shall exercise all due care and attention when visiting such premises.

3.2. The Supplier shall comply with all applicable national and local laws and regulations (including Data Protection Requirements) and obtain and maintain at its own cost throughout the duration of the Contract all the consents (including Data Protection Requirements), licences, permits and approvals which are necessary for the Supplier to perform its duties under this Contract and to enable the provision of the Ordered Services.

3.3. Without prejudice to the provisions of Clause 3.2, the Supplier shall ensure that he/she does not work in excess of the working time limits specified in the Working Time Regulations 1998. The Supplier shall maintain appropriate records regarding their working hours. Without prejudice to the obligations under this Clause 3.3, the Supplier shall make available to the Client any information of which it is aware concerning appointments held by an individual concurrently with the obligations of this Contract.

3.4. The Supplier shall be responsible for the administration and deduction of any income tax and national insurance in respect of payments made to such individuals, including in respect of any obligations under the Pay As You Earn system. The Supplier will, or procure that its Sub-Suppliers will, account to the appropriate authorities for any income tax, national insurance (if any), VAT and all other liabilities, charges and duties arising out of any payment made to the Supplier under any Purchase Order. The Supplier will indemnify and keep indemnified the Client against any income tax, national insurance (if any), VAT or any other tax liability including any interest, penalties or costs incurred in connection with the same which may at any time be levied, demanded or assessed on the Client by any statutory Agency in respect of payments made to the Supplier.

3.5. Nothing in this Contract shall be construed or have effect as constituting any relationship of employer and employee between the Client and the Supplier or its Sub-Suppliers. The Supplier shall indemnify and keep indemnified the Client, its officers, employees and agents against all actions, claims, demands, reasonable costs, charges and reasonable expenses incurred by or made against the Client, its officers, employees or agents arising out of or in connection with any services provided under any Purchase Order asserting that they are an employee of the Client or otherwise alleging any breach of any employment related legislation except where such claim arises as a result of any breach of obligations (whether contractual, statuary, at common law or otherwise).

4. MATERIAL BREACH

4.1. If the Supplier: -

does not, in the reasonable opinion of the Client Representative have the skills and experience required for the role of Supplier; or

fails to follow reasonable instructions given by the Client's Representative in the course of his or her work for the Client; or

presents, in the reasonable opinion of the Client's Representative, a risk to security; or

presents, in the reasonable opinion of the Client's Representative, a risk to the reputation of Her Majesty's Government; or

in the reasonable opinion of the Client's Representative is in some other ways unsuitable for to which he has been assigned pursuant to any Purchase Order;

then the Client may serve a notice on the Supplier requesting that the Supplier immediately cease activities under any Purchase Order.

4.2. Upon receipt of a notice under Clause 4.1 the Supplier shall immediately cease all activities in connection with the Client's instructions.

4.3. Notwithstanding the foregoing, the Client may, at any time, deny access to the Client's or its associates' premises without giving any reason for doing so.

4.4. Any activities performed prior to cessation under 4.1 shall be reimbursed on a *quantum meruit* basis.

5. NON-SOLICITATION

The parties agree that during the term of the appointment as described in any Purchase Order and for a period of twelve (12) months thereafter, they will not, whether directly or indirectly, solicit with a view to offering employment the other party and/or its employees or consultants. In the event that either party breaches this Clause, the defaulting party shall pay to the affected party all unavoidable and

reasonable costs incurred by the affected party including but not limited to a sum equal to the gross salary of the employee or the consultant due under any relevant notice. This Clause shall not restrict either party from appointing any person, whether employee or consultant of the other or not, who has applied in response to an advertisement properly and publicly placed in the normal course of business.

6. PARTIES RESPONSIBILITIES & OBLIGATIONS

The responsibilities for the Parties are set out in Schedule 2 and Schedule 3

7. CHARGES FOR ORDERED SERVICES

7.1. All engagements of the Supplier by the Client, of whatever nature, under the terms of the Agreement must be confirmed by means of a Purchase Order before commencement of the work.

7.2. All Charges on any Purchase Order placed under the terms and conditions of this Contract shall utilise the rates as per Schedule 4 as their basis.

7.3. In consideration of the performance of the Ordered Services in accordance with this Contract, the Client shall pay the Charges in accordance with the Invoicing Procedure.

7.4. Payment shall be made within thirty (30) days of receipt by the Client (at its nominated address for invoices) of a valid invoice (which shall be issued in arrears) from the Supplier.

7.5. The Charges are exclusive of Value Added Tax. The Client shall pay the Value Added Tax on the Charges at the rate and in the manner prescribed by law, from time to time.

7.6. "VAT on VAT" Prevention:

The Supplier shall not invoice, nor shall the Client be responsible for, any "VAT on VAT" payment. For the avoidance of doubt, in the event that:

a) the Supplier has incurred expenditure for goods or services from a third-party provider in respect of which the Supplier is entitled to reimbursement by the Client under the Contract; and

b) the third-party provider with whom the expenditure has been incurred has charged the Supplier UK VAT on the price of the relevant goods or services;

7.7. Interest shall be payable on any late payments under the Contract in accordance with the Late Payment of Commercial Debts (Interest) Act 1998.

7.8. The Supplier shall follow the Purchase Order and Invoice process as set out in Schedule 5. All invoices must reference the duly authorised Purchase Order number. Any invoices which do not reference the Purchase Order number shall be returned as unacceptable.

7.9. The Supplier shall continuously indemnify the Client against any liability, including any interest, penalties or reasonable costs incurred which is levied, demanded or assessed on the Client at any time in respect of the Supplier's failure to account for or to pay any Value Added Tax relating to payments made to the Supplier under this Contract. Any amounts due under this Clause 7.8 shall be paid in cleared funds by the Supplier to the relevant Agency not less than five (5) Working Days before the date upon which the tax or other liability is payable by the Client.

7.10. The Supplier shall accept the Government Procurement Card (GPC) as a means of payment for Ordered Services where GPC is agreed with the Client to be a suitable means of payment.

7.11. The Supplier shall accept payment electronically via the Banks Automated Clearing Service (BACS).

7.12. Euro

In the event that the United Kingdom joins the Economic and Monetary Union (and provided always that the exchange rate for conversion between Sterling and the Euro has been fixed), the Client shall at any time thereafter upon three (3) Months notice to the Supplier, be entitled to require the Supplier at no additional charge to convert the Charges from Sterling into Euros (in accordance with EC Regulation number 1103/97). The Supplier shall thereafter submit valid invoices denominated in Euros.

7.13. Efficiency

The Supplier shall be obliged at all times to seek to improve its efficiency in providing Services to the Client and to review the level of Charges in light of possible efficiency gains. Where such improved efficiency is achieved the Supplier shall propose a reduction in the level of Charges and effect such reduction by agreement with the Client.

8. AMENDMENTS and VARIATIONS TO THIS CONTRACT

No amendment to the provisions of this Contract or Special Terms specified in any Purchase Order shall be effective unless agreed in writing on a Variation form by both parties. Any increases in scope or value shall be the subject of separate negotiation but shall, in any event, be upon no less favorable terms than those contained herein.

9. COMMUNICATIONS

Except as otherwise expressly provided, no communication from one party to the other shall have any validity unless made in writing; nor shall any amendment to any Purchase Order be effected unless made by a duly authorised Purchase Order revision/Contract Variation.

10. TERM AND TERMINATION

10.1. This Contract shall take effect from the agreed start date and shall terminate when all requirements are satisfied.

10.2. The contract shall be subject to termination for convenience by either party subject to three months notice.

10.3. The Client may at any time by notice in writing terminate any Purchase Order, or a part thereof, at 20 days notice without charge. Terminations at less than 20 days notice shall be subject to the Supplier's standard terms and conditions

11. CONSEQUENCES OF TERMINATION AND EXPIRY

11.1. In the event of termination in accordance with Clauses 10.2 or 10.3 the Client shall reimburse the Supplier any Charges incurred prior to termination which are wholly, reasonably and properly chargeable by the Supplier in connection with the Contract. The Client shall not be liable to pay any severance payment or compensation to the Supplier for loss of profits suffered as a result of the termination. Determination of such Charges shall be on a *quantum meruit* basis.

11.2. Termination, or partial termination, or expiry in accordance with Clause 10 shall not prejudice or affect any right of action or remedy that shall have accrued or shall thereafter accrue to either party.

11.3. In the event of termination of the Contract for any reason:

a) the Supplier shall return to the Client all Client Property and all Client Data and other items belonging to the Client in its possession;

b) subject to the payment of the appropriate portion for work completed, the Supplier shall provide the Client with a copy of all work undertaken to date (whether completed or not). and

c) Upon expiry or termination for any reason, the Supplier shall render reasonable assistance to the Client (and any third parties appointed by the Client) if requested, to the extent necessary to effect an orderly cessation of the Services.

12. WARRANTIES AND REPRESENTATIONS

12.1. The Supplier warrants and represents that:

a) it has full capacity and all necessary consents to enter into and to perform the duties as specified herein;

b) this Contract shall be performed in compliance with all applicable laws, enactments, orders, regulations and other similar instruments as amended from time to time;

c) the Supplier warrants that the Ordered Services shall be provided and carried out by appropriately experienced, qualified and trained personnel with all due skill, care and diligence;

d) it shall discharge its obligations hereunder with all due skill, care and diligence including good industry practice and (without limiting the generality of this Clause 12, in accordance with its own established internal procedures;

e) it owns, has obtained or shall obtain valid licenses for all Intellectual Property Rights that are necessary for the performance of this Contract and the use of the Ordered Services by the Client;

f) it has taken and shall continue to take all reasonable steps, in accordance with good industry practice, to prevent the introduction, creation or propagation of any disruptive element (including any virus, worm and/or trojan horse) onto the Ordered Service and into systems, data, software or Confidential Information (held in electronic form) owned by or under the control of, or used by, the Client;

g) it shall take all reasonable measures to avoid any and all data loss and data corruption during the provision of the Ordered Services in accordance with good industry practice;

13. LIMITATION OF LIABILITY

13.1. Neither the Client nor the Supplier excludes or limits liability to the other for death or personal injury arising from its negligence or any breach of any obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982 or for fraud or fraudulent misrepresentation.

13.2. Nothing in this Clause 13 shall be taken as limiting the liability of the Supplier in respect of Clause 14, Clause 15, and Clause 16.

13.3. Subject always to the provisions of Clauses 13.1 and 13.2 the aggregate liability of the Client and the Supplier for each Year for all Defaults whether arising under contract, tort (including negligence) or otherwise in connection with this Contract shall in no event exceed whichever is the greater of Five hundred thousand pounds or a sum equivalent to one hundred and twenty five percent (125%) of the total charges paid or payable to the Supplier under all contracts entered into during a twelve (12) Month period specified by the claiming party, such twelve (12) Month period including the date on which at least one such Default arose.

13.4. Subject always to the provisions of Clauses 13.1 and 13.2 , in no event shall either the Client or the Supplier be liable to the other for:

a) indirect or consequential loss or damage; and/or

b) loss of profits, business, revenue, goodwill or anticipated savings.

13.5. Subject always to the provisions of Clauses 13.1, 13.2 and **Error! Reference source not found.**, the provisions of Clause 13.4 shall not be taken as limiting the right of either the Client or the Supplier to claim from the other for:

a) reasonable additional operational and administrative costs and expenses;

b) any reasonable costs or expenses rendered nugatory; and

c) damage due to the loss of data, but only to the extent that such losses relate to the costs of working around any loss of data and the direct costs of recovering or reconstructing such data,

resulting directly from the Default of the other party.

13.6. The Client and the Supplier expressly agree that should any limitation or provision contained in this Clause 13 be held to be invalid under any applicable statute or rule of law it shall to that extent be deemed omitted, but if any either of them thereby becomes liable for loss or damage which would otherwise have been excluded such liability shall be subject to the other limitations and provisions set out herein.

14. DATA PROTECTION

14.1. The Supplier shall comply at all times with the Data Protection Requirements and shall not perform its obligations under this Contract in such a way as to cause the Client to breach any of its applicable obligations under the Data Protection Requirements.

14.2. The Supplier shall be liable for and shall indemnify (and keep indemnified) the Client against each and every action, proceeding, liability, reasonable cost, claim, loss, reasonable expense (including reasonable legal fees and disbursements on a solicitor and Agency basis) and demand incurred by the Client which arise directly or in connection with the Supplier's data processing activities under this Contract, including without limitation those arising out of any third party demand, claim or action, or any breach of contract, negligence, fraud, willful misconduct, breach of statutory duty or non-compliance with any part of the Data Protection Requirements by the Supplier or its employees, servants, agents or Sub-Suppliers.

14.3 The Parties acknowledge that for the purposes of the Data Protection Legislation, the Client is the Controller and the Supplier is the Processor. The only processing that the Supplier is authorised to do is listed in Schedule 12 by the Client and may not be determined by the Supplier.

14.4 The Supplier shall notify the Client immediately if it considers that any of the Client's instructions infringe the Data Protection Legislation.

14.5 The Supplier shall provide all reasonable assistance to the Client in the preparation of any Data Protection Impact Assessment prior to commencing any processing. Such assistance may, at the discretion of the Client, include:

(a) a systematic description of the envisaged processing operations and the purpose of the processing;

(b) an assessment of the necessity and proportionality of the processing operations in relation to the Services;

(c) an assessment of the risks to the rights and freedoms of Data Subjects; and

(d) the measures envisaged to address the risks, including safeguards, security measures and mechanisms to ensure the protection of Personal Data.

14.6 The Supplier shall, in relation to any Personal Data processed in connection with its obligations under this Agreement:

(a) process that Personal Data only in accordance with Schedule 12, unless the Supplier is required to do otherwise by Law. If it is so required the Supplier shall promptly notify the Client before processing the Personal Data unless prohibited by Law;

(b) ensure that it has in place Protective Measures, which have been reviewed and approved by the Client as appropriate to protect against a Data Loss Event having taken account of the:

(i) nature of the data to be protected;

(ii) harm that might result from a Data Loss Event;

(iii) state of technological development; and

(iv) cost of implementing any measures;

(c) ensure that :

(i) the Supplier Personnel do not process Personal Data except in accordance with this Agreement (and in particular Schedule 12;

(ii) it takes all reasonable steps to ensure the reliability and integrity of any Supplier Personnel who have access to the Personal Data and ensure that they:

(A) are aware of and comply with the Supplier's duties under this clause;

(B) are subject to appropriate confidentiality undertakings with the Supplier or any Sub-processor;

(C) are informed of the confidential nature of the Personal

Data and do not publish, disclose or divulge any of the Personal Data to any third Party unless directed in writing to do so by the Client or as otherwise permitted by this Agreement; and

(D) have undergone adequate training in the use, care, protection and handling of Personal Data; and

(d) not transfer Personal Data outside of the EU unless the prior written consent of the Client has been obtained and the following conditions are fulfilled:

(v) the Client or the Supplier has provided appropriate safeguards in relation to the transfer (whether in accordance with GDPR Article 46 or LED Article 37) as determined by the Client;

(vi) the Data Subject has enforceable rights and effective legal remedies;

(vii) the Supplier complies with its obligations under the Data Protection Legislation by providing an adequate level of protection to any Personal Data that is transferred (or, if it is not so bound, uses its best endeavours to assist the Client in meeting its obligations); and

(viii) the Supplier complies with any reasonable instructions notified to it in advance by the Client with respect to the processing of the Personal Data;

(e) at the written direction of the Client, delete or return Personal Data (and any copies of it) to the Client on termination of the Agreement unless the Supplier is required by Law to retain the Personal Data.

14.7 Subject to clause 1.6, the Supplier shall notify the Client immediately if it:

(a) receives a Data Subject Access Request (or purported Data Subject Access Request);

(b) receives a request to rectify, block or erase any Personal Data;

(c) receives any other request, complaint or communication relating to either Party's obligations under the Data Protection Legislation;

(d) receives any communication from the Information Commissioner or any other regulatory authority in connection with Personal Data processed under this Agreement;

(e) receives a request from any third Party for disclosure of Personal Data where compliance with such request is required or purported to be required by Law; or

(f) becomes aware of a Data Loss Event.

14.8 The Supplier's obligation to notify under clause 1.5 shall include the provision of further information to the Client in phases, as details become available.

14.9 Taking into account the nature of the processing, the Supplier shall provide the Client with full assistance in relation to either Party's obligations under Data Protection Legislation and any complaint, communication or request made under clause 1.5 (and insofar as possible within the timescales reasonably required by the Client) including by promptly providing:

(a) the Client with full details and copies of the complaint, communication or request;

(b) such assistance as is reasonably requested by the Client to enable the Client to comply with a Data Subject Access Request within the relevant timescales set out in the Data Protection Legislation;

(c) the Client, at its request, with any Personal Data it holds in relation to a Data Subject;

(d) assistance as requested by the Client following any Data Loss Event;

(e) assistance as requested by the Client with respect to any request from the Information Commissioner's Office, or any consultation by the Client with the Information Commissioner's Office.

14.10 The Supplier shall maintain complete and accurate records and information to demonstrate its compliance with this clause. This requirement does not apply where the Supplier employs fewer than 250 staff, unless:

(a) the Client determines that the processing is not occasional;

(b) the Client determines the processing includes special categories of data as referred to in Article 9(1) of the GDPR or Personal Data relating to criminal convictions and offences referred to in Article 10 of the GDPR; and

(c) the Client determines that the processing is likely to result in a risk to the rights and freedoms of Data Subjects.

14.11 The Supplier shall allow for audits of its Data Processing activity by the Client or the Client's designated auditor.

14.12 The Supplier shall designate a data protection officer if required by the Data Protection Legislation.

14.13 Before allowing any Sub-processor to process any Personal Data related to this Agreement, the Supplier must:

(a) notify the Client in writing of the intended Sub-processor and processing.

(b) obtain the written consent of the Client;

(c) enter into a written agreement with the Sub-processor which give effect to the terms set out in this clause such that they apply to the Sub-processor; and

(d) provide the Client with such information regarding the Sub-processor as the Client may reasonably require.

14.14 The Supplier shall remain fully liable for all acts or omissions of any Sub-processor.

14.15 The Client may, at any time on not less than 30 Working Days' notice, revise this clause by replacing it with any applicable controller to processor standard clauses or similar terms forming part of an applicable certification scheme (which shall apply when incorporated by attachment to this Agreement).

14.16 The Parties agree to take account of any guidance issued by the Information Commissioner's Office. The Client may on not less than 30 Working Days' notice to the Supplier amend this agreement to ensure that it complies with any guidance issued by the Information Commissioner's Office.

15. INTELLECTUAL PROPERTY RIGHTS

15.1. Save as granted under this Contract, neither the Client nor the Supplier shall acquire any right, title or interest in the other's Pre-Existing Intellectual Property Rights respectively save that each party hereby grants a royalty-free, non-exclusive (No sub-license) license to the other party to use its Pre-Existing Intellectual Property Rights to the extent necessary to perform its obligations under this Contract.

15.2. All Intellectual Property Rights that are created by the Supplier in the provision of the Services to the Client shall be proprietary to and owned by the Client and the Supplier shall enter into such documentation and perform such acts as the Client shall request to properly vest such Intellectual Property Rights in the Client. Accordingly the Supplier hereby assigns (by way of present assignment of future intellectual property rights) all such Intellectual Property Rights.

15.3. The Supplier shall procure that the provision of the Ordered Services shall not infringe any Intellectual Property Rights of any third party.

15.4. The Supplier shall indemnify the Client against all claims, demands, actions, costs, expenses (including legal costs and disbursements on a solicitor and Agency basis), losses and damages arising from or incurred by reason of any infringement or alleged infringement (including the defence of such alleged infringement) of any Intellectual Property Right in connection with the provision of the Ordered Services, except to the extent that such liabilities have resulted directly from the Client failure properly to observe its obligations under this Clause 15.

15.5. Each of the parties shall notify the other if it receives notice of any claim or potential claim relating to the other party's Pre-Existing Intellectual Property Rights

16. CONFIDENTIALITY

16.1. Without prejudice to the application of the Official Secrets Acts 1911 to 1989 to any Confidential Information, the Client and the Supplier acknowledge that any Confidential Information originating from:

a) the Client, its servants or agents is the property of the Client; and

b) the Supplier, its employees, servants or agents is the property of the Supplier.

16.2. The Supplier and the Client shall procure that:

a) any person employed or engaged by them (in connection with this Contract in the course of such employment or engagement) shall only use Confidential Information for the purposes of this Contract;

b) any person employed or engaged by them in connection with this Contract shall not, in the course of such employment or engagement, disclose any Confidential Information to any third party without the prior written consent of the other party;

c) they shall take all necessary precautions to ensure that all Confidential Information is treated as confidential and not disclosed (save as aforesaid) or used other than for the purposes of this Contract by their employees, servants, agents or Sub-Suppliers; and

d) without prejudice to the generality of the foregoing neither the Client nor the Supplier nor any person engaged by them whether as a servant or a consultant or otherwise shall use the Confidential Information for the solicitation of business from the other or from any third party.

16.3. The provisions of Clause 16.1 and Clause 16.2 shall not apply to any information which:

a) is or becomes public knowledge other than by breach of this Clause 16; or

b) is in the possession of the recipient without restriction in relation to disclosure before the date of receipt from the disclosing party; or

c) is received from a third party who lawfully acquired it and who is under no obligation restricting its disclosure; or

d) is independently developed without access to the Confidential Information; or

e) must be disclosed pursuant to a statutory, legal or parliamentary obligation placed upon the party making the disclosure, including any requirements for disclosure under the Freedom of Information Act 2000 or the Environmental Information Regulations 2004.

f) is required to be disclosed by a competent regulatory Agency (including the Law Society or Solicitors Disciplinary Tribunal) or pursuant to any applicable rules of professional conduct.

16.4. Nothing in this Clause 16 shall be deemed or construed to prevent the Client from disclosing any Confidential Information obtained from the Supplier:

a) to any other department, office or agency of Her Majesty's Government ("Crown Bodies"), provided that the Client has required that such information is treated as confidential by such Crown Bodies and their servants, including, where appropriate, requiring servants to enter into a confidentiality agreement prior to disclosure of the Confidential Information and the Client shall have no further liability for breach of confidentiality in respect of the departments, offices and agencies. All Crown Bodies in receipt of such Confidential Information shall be considered as parties to this Contract within Section 1(1) of the Contracts (Rights of Third Parties) Act 1999 for the purpose only of being entitled to further disclose the Confidential Information to other Crown Bodies on such terms; and

b) to any consultant, Supplier or other person engaged by the Client in connection herewith, provided that the Client shall have required that such information be treated as confidential by such consultant, Supplier or other person, together with their servants including, where appropriate, requiring servants to enter into a confidentiality agreement prior to disclosure of the Confidential Information and the Client shall have no further liability for breach of confidentiality in respect of consultants, Suppliers or other people.

16.5. The Supplier shall, prior to commencing any work, enter into a confidentiality undertaking in the form set out in Schedule 7.

16.6. If required by the Client, the Supplier shall procure that any of its Staff or associates enters into a confidentiality undertaking in the form set out in Schedule 7 or such alternative form as the Client may substitute from time to time

16.7. Nothing in this Clause 16 shall prevent the Supplier or the Client from using data Processing techniques, ideas and know-how gained during the performance of this Contract in the furtherance of its normal business, to the extent that this does not relate to a disclosure of Confidential Information or an infringement by the Client or the Supplier of any Intellectual Property Rights.

17. PUBLICITY

17.1. The Supplier shall not make any press announcements or publicise this Contract in any way without the Client's prior written consent.

17.2. Notwithstanding the provisions of Clause 17.1, the Supplier shall be entitled to make any announcement required by any securities exchange or regulatory Agency or government body to which it subscribes whether or not the requirement has the force of law.

18. DISPUTE RESOLUTION

18.1. Subject to the provisions of Clause 18.2, any dispute arising under, or in connection with this Contract shall be dealt with in accordance with this Clause 18, and neither the Client nor the Supplier shall be entitled to commence or pursue any legal proceedings under the jurisdiction of the courts in connection with any such dispute, until the procedures set out in this Clause 18 have been exhausted.

18.2. Clause 18.1 shall be without prejudice to the rights of termination stated in Clause 10 and in addition shall not prevent the Client or the Supplier from applying for injunctive relief in the case of:

a) breach or threatened breach of confidentiality;

b) infringement or threatened infringement of its Intellectual Property Rights; or

c) Infringement or threatened infringement of the Intellectual Property Rights of a third party, where such infringement could expose the Client or the Supplier to liability.

18.3. All disputes between the Client and the Supplier arising out of or relating to any Purchase Order shall be referred by Client's Representative or the nominated head of the Supplier's Accountant Management Team to the other for resolution.

18.4. If any dispute cannot be resolved pursuant to the provisions of Clause 18.3 within ten (10) Working Days either party may refer the dispute to the Client's Head of Procurement for resolution.

18.5. If any dispute cannot be resolved pursuant to the provisions of Clause 18.4 within ten (10) Working Days, then either party may refer the dispute to mediation and if necessary thereafter to the courts in accordance with the provisions of Schedule 6.

19. INSURANCE

19.1. The Supplier shall effect and maintain policies of insurance to provide a level of cover sufficient for all risks which may be incurred by the Supplier under this Contract, including death or personal injury, or loss of or damage to property.

19.2. The Supplier shall hold employer's liability insurance in respect of its employees in accordance with any legal requirement for the time being in force.

19.3. The Supplier shall produce to the Client's Representative, within five (5) Working Days of request, copies of all insurance policies referred to in Clause 19.1 and Clause 19.2 or such other evidence as agreed between the Client and the Supplier that will confirm the extent of the cover given by those policies.

19.4. The terms of any insurance or the amount of cover shall not relieve the Supplier of any liabilities under this Contract. It shall be the responsibility of the Supplier to ensure that the amount of insurance cover is adequate to enable it to satisfy all its potential liabilities subject to the limit of liability specified in Clause 13 of this Contract.

20. RECOVERY OF SUMS DUE

a) The Client shall be permitted to deduct and withhold from any sum due to the Supplier under this Contract any sum of money due from the Supplier under this Contract.

21. STATUTORY REQUIREMENTS

21.1. The Supplier shall notify the Client of all statutory provisions and approved safety standards applicable to the Ordered Services and their provision and shall be responsible for obtaining all licenses, consents or permits required for the performance of this Contract.

21.2. The Supplier shall inform the Client if the Ordered Services are hazardous to health or safety and of the precautions that should be taken in respect thereto.

21.3. The Supplier shall, and shall ensure that its personnel, agents and Sub-Suppliers, take all measures necessary to comply with the requirements of the Health and Safety at Work etc. Act 1974 and any other acts, orders, regulations and codes of practice relating to health and safety, which may apply to those involved in the performance of this Contract.

22. STATUTORY INVALIDITY

The Client and the Supplier expressly agree that should any limitation or provision contained in this Contract be held to be invalid under any particular statute or law, or any rule, regulation or bye-law having the force of law, it shall to that extent be deemed to be omitted but, if either the Client or the Supplier thereby becomes liable for loss or damage which would have otherwise been excluded, such liability shall be subject to the other limitations and provisions set out herein.

23. ENVIRONMENTAL REQUIREMENTS

23.1. The Supplier shall comply in all material respects with all applicable environmental laws and regulations in force from time to time in relation to the Services. Without prejudice to the generality of the foregoing, the Supplier shall promptly provide all such information regarding the environmental impact of the Services as may reasonably be requested by the Client.

23.2. The Supplier shall meet all reasonable requests by the Client for information evidencing compliance with the provisions of this Clause 23 by the Supplier.

24. DISCRIMINATION

24.1. The Supplier shall not unlawfully discriminate either directly or indirectly on such grounds as race, colour, ethnic or national origin, disability, sex or sexual orientation, religion or belief, or age and without prejudice to the generality of the foregoing the Supplier shall not unlawfully discriminate within the meaning and scope of the Equality Act 2010, the Human Rights Act 1998 or other relevant or equivalent legislation, or any statutory modification or re-enactment thereof. The Supplier shall take all reasonable steps to secure the observance of this Clause by all Staff.

24.2. The Supplier shall take all reasonable steps to secure the observance of the provisions of Clause 24.1 by any Sub-Supplier(s) employed in the execution of this Contract.

25. SUPPLIER'S SUITABILITY

25.1. The Client reserves the right under this Contract to refuse to admit to any premises occupied by or on behalf of the Client the Supplier, whose admission has become, in the opinion of the Client, undesirable.

25.2. If the Supplier shall fail to comply with Clause 25.1 and if the Client (whose decision shall be final and conclusive) shall decide that such failure is prejudicial to the interests of the State and if the Supplier does not comply with the provisions of Clause 25.1 within a reasonable time of written notice so to do, then the Client may terminate the any Purchase Order provided always that such termination shall not prejudice or affect any right of action or remedy which shall have accrued or shall thereafter accrue to the Client.

26. OFFICIAL SECRETS ACTS

The Supplier shall take all reasonable steps to ensure that he and all people employed by him or his agents and Sub-Suppliers in connection with this Contract are aware of the Official Secrets Act 1989 and where appropriate, with the provisions of the Atomic Energy Act 1946, and that these Acts apply to them during the execution of this Contract and after the expiry or termination of this Contract.

27. CORRUPT GIFTS AND PAYMENTS OF COMMISSION

27.1. The Supplier shall not:

a) offer or give or agree to give any person in Her Majesty's Service any gift or consideration of any kind as an inducement or reward for doing, forbearing to do, or for having done or forborne to do any act in relation to the obtaining or execution of this Contract or any other contract for Her Majesty's Service or for showing favour or disfavour to any person in relation to this or any other contract for Her Majesty's Service;

b) enter into this Contract or any other contract with a person in Her Majesty's Service in connection with which commission has been paid or agreed to be paid by him or on his behalf, or to his knowledge, unless before this Contract are accepted, made particulars of any such commission and of the terms and conditions of any agreement for the payment thereof have been disclosed in writing to the Client.

27.2. Any breach of Clause 27.1 by the Supplier or by anyone employed by him or acting on his behalf (whether with or without the knowledge of the Supplier) or the commission of any offence by the Supplier or by anyone employed by him or acting on his behalf under the Prevention of Corruption Acts 1889 to 1916, in relation to this Contract or any other contract with Her Majesty's Service shall entitle the Client to terminate any Purchase Order and recover from the Supplier the amount of any direct loss resulting from such termination and/or to recover from the Supplier the amount or value of any such gift, consideration or commission.

27.3. Any dispute, difference or question arising in respect of the interpretation of this Clause 27, the right of the Client to terminate any Purchase Order or the amount or value of any such gift, consideration or commission shall be decided by the Client, whose decision shall be final and conclusive.

27.4. Either Party may terminate this contract and recover all its losses if the other Party, their employees or anyone acting on their behalf:

a. Corruptly offers, gives or agrees to give to anyone any inducement or reward in respect of this Contract; or

b. Commits an offence under the Bribery Act 2010.

28. TRANSFER AND SUB-CONTRACTING

28.1. Sub-contracting will be allowed, subject to written authorisation from the Client.

28.2. The Client shall be entitled to nominate sub-Suppliers at its discretion.

28.3. The Supplier shall be entitled to Sub-Contract its obligations under this Contract, or any resultant Purchase Order, solely with the express permission of the Client Representative; such permission shall not be unreasonably withheld.

28.4. Any sub-contract must allow for full disclosure under 'transparency' requirements.

28.5. The Client shall be entitled to assign or otherwise dispose of its rights and obligations under this Contract and/or any relevant Purchase Order to any other body (including any private sector body) which substantially performs any of the functions that previously had been performed by the Client.

29. RIGHTS OF THIRD PARTIES

29.1. To the extent that this Contract are expressed to confer rights or benefits on a party who is not a party to this Contract, that party shall by virtue of the Contracts (Rights of Third Parties) Act 1999, be entitled to enforce those rights as if it was a party to this Contract. For the avoidance of doubt the consent of any person other than the Client (or the Supplier, as the case may be) is not required to vary or terminate this Contract.

29.2. Except as provided in Clause 29.1, a person who is not a party to this Contract shall have no rights under the Contracts (Rights of Third Parties) Act 1999 to enforce any term of this Contract. This Clause 29.2 does not affect any right or remedy of any person that exists or is available otherwise than pursuant to that Act.

30. CLIENT PROPERTY

30.1. All Client Property shall remain the property of the Client and shall be used only for the purposes of the Contract.

30.2. The Supplier undertakes the safe custody of and the due return of all Client Property and shall be responsible for all reasonably foreseeable loss thereof from whatever cause and shall indemnify the Client against such loss.

30.3. Neither the Supplier, nor any SubSupplier nor any other person shall have a lien on any Client Property for any sum due to the Supplier, SubSupplier or other person and the Supplier shall take all reasonable steps to ensure that the title of the Client and the exclusion of any such lien are brought to the notice of all SubSuppliers and other persons dealing with any Client Property

31. SEVERABILITY

Subject to the provisions of Clause 22, if any provision of this Contract is held invalid, illegal or unenforceable for any reason, such provision shall be severed and the remainder of the provisions hereof shall continue in full force and effect as if this Contract had been accepted with the invalid provision eliminated. In the event of a holding of invalidity so fundamental as to prevent the accomplishment of the purpose of this Contract, the Client and the Supplier shall immediately commence good faith negotiations to remedy such invalidity.

32. FREEDOM OF INFORMATION

32.1. The Supplier acknowledges that the Client is subject to the requirements of the Code of Practice on Government Information, FOIA and the Environmental Information Regulations and shall assist and cooperate with the Client to enable the Client to comply with its Information disclosure obligations.

32.2. The Supplier shall, and shall procure that its Sub-Suppliers shall:

- transfer to the Client all Requests for Information that it receives as soon as practicable and in any event within two Working Days of receiving a Request for Information;

- provide the Client with a copy of all Information in its possession, or power in the form that the Client requires within five Working Days (or such other period as the Client may specify) of the Client's request; and
- provide all necessary assistance as reasonably requested by the Client to enable the Client to respond to the Request for Information within the time for compliance set out in section 10 of the FOIA or regulation 5 of the Environmental Information Regulations.

32.3. The Client shall be responsible for determining in its absolute discretion and notwithstanding any other provision in this Contract or any other contract whether the Commercially Sensitive Information and/or any other information is exempt from disclosure in accordance with the provisions of the Code of Practice on Government Information, FOIA or the Environmental Information Regulations.

32.4. In no event shall the Supplier respond directly to a Request for Information unless expressly authorised to do so by the Client.

32.5. The Supplier acknowledges that (notwithstanding the provisions of Clause 42 – Transparency, the Client may, be obliged under the FOIA, or the Environmental Information Regulations to disclose information concerning the Supplier or the Services:

- in certain circumstances without consulting the Supplier; or
- following consultation with the Supplier and having taken their views into account;

provided always that where [reference] applies the Client shall, in accordance with any recommendations of the Code, take reasonable steps, where appropriate, to give the Supplier advanced notice, or failing that, to draw the disclosure to the Supplier's attention after any such disclosure.

32.6. The Supplier shall ensure that all Information is retained for disclosure and shall permit the Client to inspect such records as requested from time to time.

32.7. The Supplier acknowledges that the Commercially Sensitive Information listed in Schedule 9 (if any) is of indicative value only and that the Client may be obliged to disclose it in accordance with clause 32.

33. FORCE MAJEURE

33.1. For the purposes of this Contract the expression "Force Majeure" shall mean any cause affecting the performance by either the Client or the Supplier of its obligations arising from acts, events, omissions, happenings or non-happenings beyond its reasonable control including (but without limiting the generality thereof) governmental regulations, fire, flood, or any disaster or an industrial dispute affecting a third party for which a substitute third party is not reasonably available. Any act, event, omission, happening or non-happening will only be considered Force Majeure if it is not attributable to the willful act, neglect or failure to take reasonable precautions of the affected party, its employees, servants or agents or the failure of either the Client or the Supplier to perform its obligations under any Purchase Order.

33.2. It is expressly agreed that any failure by the Supplier to perform or any delay by the Supplier in performing its obligations under any Purchase Order which results from any failure or delay in the performance of its obligations by any person, firm or company with which the Supplier shall have entered into any contract, supply arrangement or Sub-Contract or otherwise shall be regarded as a failure or delay due to Force Majeure only in the event that such person firm or company shall itself be prevented from or delayed in complying with its obligations under such Purchase Order, supply arrangement or Sub-Contract or otherwise as a result of circumstances of Force Majeure.

33.3. Both the Client and the Supplier agree that any acts, events, omissions, happenings or non-happenings resulting from the adoption of the Euro by the United Kingdom government shall not be considered to constitute Force Majeure under this Contract.

33.4. Neither the Client nor the Supplier shall in any circumstances be liable to the other for any loss of any kind whatsoever including but not limited to any damages or abatement of Charges whether directly or indirectly caused to or incurred by the other party by reason of any failure or delay in the performance of its obligations which is due to Force Majeure. Notwithstanding the foregoing, both the Client and the Supplier shall use all reasonable endeavors to continue to perform, or resume performance of, (and having resumed to catch up to the required level of performance existing immediately prior to the Force Majeure event), such obligations hereunder for the duration of such Force Majeure event.

33.5. If either the Client or the Supplier become aware of circumstances of Force Majeure which give rise to or which are likely to give rise to any such failure or delay on its part it shall forthwith notify the other by the most expeditious method then available and shall inform the other of the period which it is estimated that such failure or delay shall continue.

33.6. It is hereby expressly declared that the only events that shall afford relief from liability for failure or delay shall be any event qualifying for Force Majeure hereunder.

34. LEGISLATIVE CHANGE

34.1. The Supplier shall bear the cost of ensuring that the Ordered Services shall comply with all applicable statutes, enactments, orders, regulations or other similar instruments and any amendments thereto, except where any such amendment could not reasonably have been foreseen by the Supplier at the date hereof.

34.2. Where such reasonably unforeseeable amendments are necessary, the Client and the Supplier shall use all reasonable endeavors to agree upon reasonable adjustments to the Charges as may be necessary to compensate the Supplier for such additional costs as are both reasonably and necessarily incurred by the Supplier in accommodating such amendments.

35. CONFLICTS OF INTEREST

The Supplier shall disclose to the Client's Representative as soon as is reasonably practical after becoming aware of any actual or potential conflict of interest relating to provision of the Services by the Supplier or any event or matter (including without limitation its reputation and standing) of which it is aware or anticipates may justify the Client taking action to protect its interests.

36. ASSIGNED STAFF

36.1. As soon as the Supplier becomes aware of any intended changes to the Account Management Team, they shall inform the Client Representative.

36.2. The Client may require the Supplier to attend a meeting and/or submit written notification of the steps it intends to take to mitigate any issues which may result from such changes.

37. INVESTIGATIONS

The Supplier shall immediately notify the Client Representative in writing if any investigations are instituted unto the affairs of the Supplier, its partners or key managers under the Companies, Financial Services or Banking Acts, or in the event of any police or Serious Fraud Office enquiries, enquires into possible fraud, any involvement in DTI investigations or any investigations by the Office for the Supervision of Solicitors which might result in public criticism of the Supplier.

38. STATUTORY AUDITORS' ACCESS

For the purposes of the examination and certification of the Client accounts or any examination, pursuant if appropriate to Section 6(1) of the National Audit Act 1983 or any re-enactment thereof, or pursuant to any equivalent legislation, of the economy, efficiency and effectiveness with which the Client has used its resources, the Client's statutory auditors may examine such documents as they may reasonably require which are owned, held or otherwise within the control of the Supplier and may require the Supplier to produce such oral or written explanations as they consider necessary. For the avoidance of doubt it is hereby declared that the carrying out of an examination, if appropriate, under section 6(3) (d) of the National Audit Act 1983 or any re-enactment thereof, or under any equivalent legislation, in relation to the Supplier is not a function exercisable under this clause 38.

39. ELECTRONIC INSTRUCTION

The Supplier shall use its reasonable endeavors to interface with any system introduced by the Client for issuing electronic instructions, in particular the FSA's Purchase Order system, and to accept such instruction.

40. WAIVER

40.1. The failure of the Supplier or the Client to insist upon strict performance of any provision of this Contract or to exercise any right or remedy to which it is entitled hereunder, shall not constitute a waiver thereof and shall not cause a diminution of the obligations established by this Contract.

40.2. A waiver of any default shall not constitute a waiver of any other default.

40.3. No waiver of any of the provisions of this Contract shall be effective unless it is expressed to be a waiver communicated by notice, in accordance with the provisions of Clause9.

41. LAW AND JURISDICTION

Subject to the provisions of Clause 18, the Client and the Supplier accept the exclusive jurisdiction of the English and Welsh courts and agree that this Contract is to be governed by and construed according to the law of England and Wales.

42. TRANSPARENCY

42.1. The Parties acknowledge that, except for any information which is exempt from disclosure in accordance with the provisions of the FOIA, the content of these Terms and Conditions and any Purchase Order is not Confidential Information.

42.2. The Client shall be responsible for determining in its absolute discretion whether any content of any Purchase Order is exempt from disclosure in accordance with the provisions of the FOIA. Notwithstanding any other term of these Terms and Conditions, the Supplier gives his consent for the Client to publish any Contract or Purchase Order in its entirety, (but with any information which is exempt from disclosure in accordance with the provisions of the FOIA redacted), to the general public.

42.3. The Client may consult with the Supplier to inform its decision regarding any redactions but the Client shall have the final decision in its absolute discretion.

43. SECURITY PROVISIONS

Supplier Personnel – Staffing Security

43.1 The Supplier shall comply with the staff vetting procedures in respect of all Supplier Personnel employed or engaged in the provision of the Services. The Supplier confirms that all Supplier Personnel employed or engaged by the Supplier at the Effective Date were vetted and recruited on such a basis that is equivalent to and no less strict than the Staff Vetting procedures as laid out by Cabinet Office: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/200551/HMG_Baseline_Personnel_Security_Standard_V3_2_Apr-2013.pdf

43.2 The Supplier shall provide training on a continuing basis for all Supplier Personnel employed or engaged in the provision of the Services in compliance with the Security Policy – Table of Policies – See Annex D.

43.3 The Supplier agrees to conform to the below standards as directed by the Client:

Baseline Standard

a) The **Baseline Standard** is not a formal security clearance but aims to provide an appropriate level of assurance as to the trustworthiness, integrity and probable reliability of prospective **Suppliers** and/or their **Staff**.
b) It should be applied to all private sector **Employees** working on government **Contracts** (e.g. **Suppliers** and consultants), who require access to the **Agency**'s premises, or knowledge or custody of, government assets protectively marked up to and including CONFIDENTIAL.
c) The outcome of checks should be recorded on the **Baseline Standard Verification Record**. This will be carried out by the **Agency's Representative.**

Enhanced Baseline Standard

Some **Contracts** may require the **Baseline Standard** to be supplemented with additional checks (e.g. a Criminal Record Check (including spent convictions) or a Credit Worthiness Check). A Criminal Record Check could take up to 2 **Weeks** to process.

43.4 The Baseline Standard comprises verification of the following four main elements:
a) Identity

b) Employment history (past 3 years)
c) Nationality and Immigration Status
d) Criminal record (unspent convictions only)

43.5 Additionally, Suppliers and their staff are required to give a reasonable account of any significant periods (6 months or more in the past 3 years) of time spent abroad.

43.6 Verification of identity is essential before any individual can begin working on the Client's premises or have access to assets/documents as described above. Before a contract is awarded Suppliers and their staff who will work on the Client's premises or have access to assets/documents as described above will be asked to provide the following:

a) Confirmation of name, date of birth and address. (ID should be corroborated by original documents i.e. full passport, national ID card, current UK full driving license, birth certificate, bank correspondence or utility bills.)

b) National insurance number or other unique personal identifying number where appropriate.

c) Full details of previous employers (name, address and dates), over the past 3 years.

d) Confirmation of any necessary qualifications/licences.

e) Educational details and references where someone is new to the workforce.

f) Confirmation of permission to work in the UK if appropriate.

43.7 Client Data

a) The Supplier shall not delete or remove any proprietary notices contained within or relating to the Client Data.

b) The Supplier shall not store, copy, disclose, or use the Client Data except as necessary for the performance by the Supplier of its obligations under this Contract or as otherwise expressly authorised in writing by the Client.

43.8 To the extent that Client Data is held and/or processed by the Supplier, the Supplier shall supply that Client Data to the Client as requested by the Client in the format specified herein:

43.9 The Supplier shall take responsibility for preserving the integrity of Client Data and preventing the corruption or loss of Client Data.

43.10 The Supplier shall perform secure back-ups of all Client Data and shall ensure that up-to-date back-ups are stored off-site in accordance with the Business Continuity

and Disaster Recovery Plan. The Supplier shall ensure that such back-ups are available to the Client at all times upon request and are delivered to the Client at no less than monthly intervals.

43.11 The Supplier shall ensure that any system on which the Supplier holds any Client Data, including back-up data, is a secure system that complies with the Security Policy.

43.12 If the Client Data is corrupted, lost or sufficiently degraded as a result of the Supplier's Default so as to be unusable, the Client may:

- require the Supplier (at the Supplier's expense) to restore or procure the restoration of Client Data to the extent and in accordance with the requirements specified in herein and the Supplier shall do so as soon as practicable but not later than two working days; and/or
- itself restore or procure the restoration of Client Data, and shall be repaid by the Supplier any reasonable expenses incurred in doing so to the extent and in accordance with the requirements specified herein

43.13 If at any time the Supplier suspects or has reason to believe that Client Data has or may become corrupted, lost or sufficiently degraded in any way for any reason, then the Supplier shall notify the Client immediately and inform the Client of the remedial action the Supplier proposes to take.

Protection of Personal Data

43.14 With respect to the parties' rights and obligations under this Contract, the parties agree that the Client is the Data Controller and that the Supplier is the Data Processor. The Supplier shall:

- process the Personal Data only in accordance with instructions from the Client (which may be specific instructions or instructions of a general nature as set out in this Contract or as otherwise notified by the Client to the Supplier during the Term);
- process the Personal Data only to the extent, and in such manner, as is necessary for the provision of the Services or as is required by Law or any Regulatory Body;
- implement appropriate technical and organisational measures to protect the Personal Data against unauthorised or unlawful processing and against accidental loss, destruction, damage, alteration or disclosure. These measures shall be appropriate to the harm which might result from any unauthorised or unlawful Processing, accidental loss, destruction or damage to the Personal Data and having regard to the nature of the Personal Data which is to be protected;
- take reasonable steps to ensure the reliability of any Supplier Personnel who have access to the Personal Data;
- obtain prior written consent from the Client in order to transfer the Personal Data to any Sub-suppliers or Affiliates for the provision of the Services;

- ensure that all Supplier Personnel required to access the Personal Data are informed of the confidential nature of the Personal Data and comply with the obligations set out in this clause 43;
- ensure that none of Supplier Personnel publish, disclose or divulge any of the Personal Data to any third party unless directed in writing to do so by the Client;
- notify the Client (within five Working Days) if it receives:
  - a request from a Data Subject to have access to that person's Personal Data; or
  - a complaint or request relating to the Client's obligations under the Data Protection Legislation;
- provide the Client with full cooperation and assistance in relation to any complaint or request made, including by:
  - providing the Client with full details of the complaint or request;
  - complying with a data access request within the relevant timescales set out in the Data Protection Legislation and in accordance with the Client's instructions;
  - providing the Client with any Personal Data it holds in relation to a Data Subject (within the timescales required by the Client); and
  - providing the Client with any information requested by the Client;
- permit the Client or the Client Representative (subject to reasonable and appropriate confidentiality undertakings), to inspect and audit, in accordance with clause 38 (Audits), the Supplier's data Processing activities (and/or those of its agents, subsidiaries and Sub-suppliers) and comply with all reasonable requests or directions by the Client to enable the Client to verify and/or procure that the Supplier is in full compliance with its obligations under this Contract;
- provide a written description of the technical and organisational methods employed by the Supplier for processing Personal Data (within the timescales required by the Client); and
- not Process Personal Data outside the European Economic Area without the prior written consent of the Client and, where the Client consents to a transfer, to comply with:
  - the obligations of a Data Controller under the Eighth Data Protection Principle set out in Schedule 1 of the Data Protection Act 1998 by providing an adequate level of protection to any Personal Data that is transferred; and
  - any reasonable instructions notified to it by the Client.

43.15 The Supplier shall comply at all times with the Data Protection Legislation and shall not perform its obligations under this Contract in such a way as to cause the Client to breach any of its applicable obligations under the Data Protection Legislation.

Confidentiality

43.16 Except to the extent set out in this clause or where disclosure is expressly permitted elsewhere in this Contract, each party shall

- treat the other party's Confidential Information as confidential [and safeguard it accordingly]; and

- not disclose the other party's Confidential Information to any other person without the owner's prior written consent.

43.17 Clause 43.13 shall not apply to the extent that:

- such disclosure is a requirement of Law placed upon the party making the disclosure, including any requirements for disclosure under the FOIA, Code of Practice on Access to Government Information or the Environmental Information Regulations pursuant to clause 32 (Freedom of Information);
- such information was in the possession of the party making the disclosure without obligation of confidentiality prior to its disclosure by the information owner;
- such information was obtained from a third party without obligation of confidentiality;
- such information was already in the public domain at the time of disclosure otherwise than by a breach of this Contract; or
- it is independently developed without access to the other party's Confidential Information.

43.18 The Supplier may only disclose the Client's Confidential Information to the Supplier Personnel who are directly involved in the provision of the Services and who need to know the information, and shall ensure that such Supplier Personnel are aware of and shall comply with these obligations as to confidentiality.

43.19 The Supplier shall not, and shall procure that the Supplier Personnel do not, use any of the Client's Confidential Information received otherwise than for the purposes of this Contract.

43.20 At the written request of the Client, the Supplier shall procure that those members of the Supplier Personnel identified in the Client's notice signs a confidentiality undertaking prior to commencing any work in accordance with this Contract.

43.21 Nothing in this Contract shall prevent the Client from disclosing the Supplier's Confidential Information:

- to other Crown Bodies or other Contracting Authorities on the basis that the information is confidential and is not to be disclosed to a third party which is not part of any Crown Body or any Contracting Agency;
- to any consultant, supplier or other person engaged by the Client or any person conducting an Office of Government Commerce gateway review;
    - for the purpose of the examination and certification of the Client's accounts; or
    - for any examination pursuant to Section 6(1) of the National Audit Act 1983 of the economy, efficiency and effectiveness with which the Client has used its resources.

43.22 The Client shall use all reasonable endeavours to ensure that any government department, Contracting Agency, employee, third party or Sub-Supplier to whom the Supplier's Confidential Information is disclosed pursuant to clause 43 is made aware of the Client's obligations of confidentiality.

43.23 Nothing in this clause 43 shall prevent either party from using any techniques, ideas or know-how gained during the performance of the Contract in the course of its normal business to the extent that this use does not result in a disclosure of the other party's Confidential Information or an infringement of IPR.

Security Requirements

43.24 The Supplier shall comply, and shall procure the compliance of the Supplier Personnel, with the Security Policy (see Table of Policies – See Annex D) and the Supplier shall ensure that the Security Plan produced by the Supplier fully complies with the Security Policy.

43.25 The Client shall notify the Supplier of any changes or proposed changes to the Security Policy.

43.26 If the Supplier believes that a change or proposed change to the Security Policy will have a material and unavoidable cost implication to the Services it may submit a Change Request. In doing so, the Supplier must support its request by providing evidence of the cause of any increased costs and the steps that it has taken to mitigate those costs. Any change to the Charges shall then be agreed in accordance with the Change Control Procedure.

43.27 Until and/or unless a change to the Charges is agreed by the Client pursuant to clause 43 the Supplier shall continue to perform the Services in accordance with its existing obligations.

Malicious Software

43.28 The Supplier shall, as an enduring obligation throughout the Term, use the latest versions of anti-virus definitions available from an industry accepted anti-virus software vendor to check for and delete Malicious Software from the ICT Environment.

43.29 Notwithstanding clause 43, if Malicious Software is found, the parties shall co-operate to reduce the effect of the Malicious Software and, particularly if Malicious Software causes loss of operational efficiency or loss or corruption of Client Data, assist each other to mitigate any losses and to restore the Services to their desired operating efficiency.

43.30 Any cost arising out of the actions of the parties taken in compliance with the provisions of clause 43 shall be borne by the parties as follows.

- by the Supplier where the Malicious Software originates from the Supplier Software, the Third Party Software or the Client Data (whilst the Client Data was under the control of the Supplier); and
- by the Client if the Malicious Software originates from the Client Software or the Client Data (whilst the Client Data was under the control of the Client);

Warranties

43.31 The Supplier warrants, represents and undertakes for the duration of the Term that all personnel used to provide the Services will be vetted in accordance with good industry practice and the Supplier's usual staff vetting procedures.

44. EXIT MANAGEMENT

44.1. On receipt of notice to terminate this Contract or a Purchase Order or expiration of this Contract or a Purchase Order, however and whenever occurring, the Parties shall comply with the Exit Management Requirements as may be set out in any appropriate Purchase Order.

44.2. During the Exit Period the Charges shall continue to apply, even where the Exit Period continues after the expiry of the Term.

44.3. In order to facilitate the Exit Management Requirements, the Supplier shall, if requested by the Client to do so, extend the Term of this Contract or a Purchase Order.

44.4. No right or licence is granted to either Party or their advisers in relation to any Confidential Information except as expressly set out in this Contract.

45. ENTIRE AGREEMENT

This Contract constitutes the entire understanding between the Client and the Supplier relating to the subject matter.

45.1. Neither the Client nor the Supplier has relied upon any representation or promise except as expressly set out in this Contract.

45.2. Both the Client and the Supplier unconditionally waives any rights it may have to claim damages against the other on the basis of any statement made by the other (whether made carelessly or not) not set out or referred to in this Contract (or for breach of any warranty given by the other not so set out or referred to) unless such statement or warranty was made or given fraudulently.

45.3. Both the Client and the Supplier unconditionally waives any rights it may have to seek to rescind this Contract on the basis of any statement made by the other (whether made carelessly or not) whether or not such statement is set out or referred to in this Contract unless such statement was made fraudulently.

This contract is deemed to have commenced at the date given on page 1.

Signed for and on behalf of the **Foods Standards Agency**:

By .....

Name.

Title....

Date ...

Signed for and on behalf of Fera Science Ltd:

By.....

Name...

Title.....

Date.....

SCHEDULE 1

INTERPRETATIONS

Account Management Team	The Supplier's personnel who have been designated as their point(s) of contact for management of this contract
Agreement	means this contract
Client Property	means anything issued or otherwise furnished in connection with the Contract by or on behalf of the Client, other than any real property.
Client's Representative	means the member of the Client staff who shall be the main contact point under the Contract or any relevant Purchase Order
Charges	means charges payable by the Client to the supplier for the performance of the Services, which must be itemised in full on any relevant Purchase Order
Confidential Information	means any information, however it is conveyed, that relates to the business, affairs, developments, trade secrets, know-how, personnel and suppliers of either party, including Intellectual Property Rights, together with all information derived from the above, and any other information clearly designated as being confidential (whether or not it is marked as "confidential") or which ought reasonably to be considered to be confidential.
Supplier Personnel	means all directors, officers, employees, agents, consultants and Suppliers of the Supplier and/or of any Sub-Supplier engaged in the performance of its obligations under this Agreement.
Controller, Processor, Data Subject, Personal Data, Personal Data Breach, Data Protection Officer	take the meaning given in the GDPR

Data Loss Event	means any event that results, or may result, in unauthorised access to Personal Data held by the Supplier under this Agreement, and/or actual or potential loss and/or destruction of Personal Data in breach of this Agreement, including any Personal Data Breach
Data Protection Impact Assessment	means an assessment by the Controller of the impact of the envisaged processing on the protection of Personal Data.
Data Protection Legislation	(i) the GDPR, the LED and any applicable national implementing Laws as amended from time to time (ii) the DPA 2018 [subject to Royal Assent] to the extent that it relates to processing of personal data and privacy; (iiii) all applicable Law about the processing of personal data and privacy.
Data Protection Requirements	mean the Data Protection Act 1998, the EU Data Protection Directive 95/46/EC, the Regulation of Investigatory Powers Act 2000, the Telecommunications (Lawful Business Practice) (Interception of Communications) Regulations 2000 (SI 2000/2699), the Electronic Communications Data Protection Directive 2002/58/EC, the Privacy and Electronic Communications (EC Directive) Regulations 2003 and all applicable laws and regulations relating to processing of personal data and privacy, including where applicable the guidance and codes of practice issued by the Information Commissioner.
Data Subject Access Request	means a request made by, or on behalf of, a Data Subject in accordance with rights granted pursuant to the Data Protection Legislation to access their Personal Data.
Default	means any breach of the obligations of any party (including but not limited to fundamental breach or breach of a fundamental term) or any default, act, omission, negligence or statement of any party, it's employees, agents or Sub-Suppliers in connection with or in relation to the subject matter of this Contract and in respect of which such party is liable to the other.
DPA 2018	Data Protection Act 2018

Environmental Information Regulations	mean the Environmental Information Regulations 2004 and any guidance and/or codes of practice issued by the Information Commissioner in relation to such regulations.
Equipment	means any computers, laptops, servers, networks, internet broadband, wireless or other connections, other computer associated equipment or presentation equipment
FOIA	means the Freedom of Information Act 2000 and any subordinate legislation made under this Act from time to time together with any guidance and/or codes of practice issued by the Information Commissioner in relation to such legislation.
GDPR	the General Data Protection Regulation (Regulation (EU) 2016/679)
Government Accounting	means HM Treasury's manual of accounting principles for government as updated from time to time
Government Procurement Card (GPC)	means the UK Government's VISA purchasing card.
Industry Regulator	means any statutory or non-statutory body with responsibility for regulating (or promoting self regulation) of the provision on the type of services being provided by the Supplier.
Information	has the meaning given under section 84 of the Freedom of Information Act 2000.
Intellectual Property Rights	means patents, trademarks, service marks, design rights (whether registerable or otherwise), applications for any of the foregoing, copyright, database rights, trade or business names and other similar rights or obligations whether registerable or not in any country (including but not limited to the United Kingdom).
Invoicing Procedure	means the procedure by which the Supplier invoices the Client, as set out in Schedule 5.

Law	means any law, subordinate legislation within the meaning of Section 21(1) of the Interpretation Act 1978, bye-law, enforceable right within the meaning of Section 2 of the European Communities Act 1972, regulation, order, regulatory policy, mandatory guidance or code of practice, judgment of a relevant court of law, or directives or requirements with which the Supplier is bound to comply.
LED	Law Enforcement Directive (Directive (EU) 2016/680)
Mediator	has the meaning ascribed to it in Schedule 6.
Month	means a calendar month and "Monthly" shall be similarly construed.
Nominated Sub-Supplier	means any sub-Supplier engaged by the Supplier, at the direction of the Client, in connection with the provision of Ordered Services
Ordered Services	means the services which the Client has instructed the Supplier to carry out in any Purchase Order, subject to Schedule 2.
Party	means a Party to this Agreement
Personal Data	shall have the same meaning as set out in the Data Protection Act 1998.
Pre-Existing Intellectual Property Rights	shall mean any Intellectual Property rights vested in or licensed to the Supplier or Client prior to or independently of the performance by the Supplier or Client of their obligations under this Contract.
Private Agency	means a commercial organisation to which service provision has been outsourced by a Contracting Agency, which assumes the role and responsibilities of the Agency under a Contract.
Protective Measures	means appropriate technical and organisational measures which may include: pseudonymising and encrypting Personal Data, ensuring confidentiality, integrity, availability and resilience of systems and services, ensuring that availability of and access to Personal Data can be restored in a timely manner after an incident, and regularly assessing and evaluating the effectiveness of the such measures adopted by it.

Purchase Order	means an order for Services served by the Client on the Supplier by means of the Client's i-Procurement system
Quarter	means a three (3) month period beginning on 1st January, 1st April, 1st July or 1st October. The term 'Quarterly' shall be similarly construed.
Regulatory Body	means those government departments and regulatory, statutory and other entities, committees and bodies which, whether under statute, rules, regulations, codes of practice or otherwise, are entitled to regulate, investigate, or influence the matters dealt with in this Contract or any other affairs of the Client and "Regulatory Body" shall be construed accordingly.
Requests for Information	means a request for information or an apparent request under the Code of Practice on Access to Government Information, FOIA or the Environmental Information Regulations.
Services	means services which the Supplier has agreed to provide under any Purchase Order.
Special Terms	means additional Client specific terms, to which the Supplier's has agreed
Specific Obligations	means any obligations entered at Schedule 3
Staff	means employees, agents and Suppliers of the Supplier
Sub-Supplier	means any sub-Supplier engaged by the Supplier in connection with the provision of Ordered Services.
Sub-Process	means any third Party appointed to process Personal Data on behalf of the Supplier related to this Agreement
Supplier	The person identified in the Contract their employees, agents or any other persons under the control of the Supplier
Working Days	means Monday to Friday inclusive, excluding English public and bank holidays.
Year	means a calendar year.

Schedule 2

THE ORDERED SERVICES

1. INTRODUCTION

This Schedule 2 specifies the Ordered Services to be provided to the Client by the Supplier in the services required for FS301050. Please see the Schedule 2 - "Evidence Requirement Document"

This Schedule will be completed by reference to the successful Tenderer's quotation.

GENERAL INTRODUCTION

The Food Standards Agency is a non-ministerial government department governed by a Board appointed to act in the public interest, with the task of protecting consumers in relation to food. It is a UK-wide body with offices in London, Cardiff, Belfast and York.

The Agency is committed to openness, transparency and equality of treatment to all suppliers. As well as these principles, for science projects the final project report will be published on the Food Standards Agency website (www.food.gov.uk). For science projects we will encourage contractors to publish their work in peer reviewed scientific publications wherever possible. Also, in line with the Government's Transparency Agenda which aims to encourage more open access to data held by government, the Agency is developing a policy on the release of underpinning data from all of its science- and evidence-gathering projects. Underpinning data should also be published in an open, accessible, and re-usable format, such that the data can be made available to future researchers and the maximum benefit is derived from it. The Agency has established the key principles for release of underpinning data that will be applied to all new science- and evidence-gathering projects which we would expect contractors to comply with. These can be found at http://www.food.gov.uk/about-us/data-and-policies/underpinning-data.

The objective of the microbiological food safety research themes is to provide robust information on the presence, growth, survival and elimination of pathogenic microorganisms throughout the food chain; the extent, distribution, causes, risks and cost of foodborne disease will also be considered where appropriate.

The main objective from the FSA's Strategic Plan for 2015-2020 is to protect public health from risks which may arise in connection with the consumption of food (including risks caused by the way in which it is produced or supplied) and otherwise to protect the interest of consumers in relation to food. This would include the reduction of foodborne disease to ensure 'food is safe'. This proposed study will consider the total burden of antimicrobial

resistance (AMR) genes in selected ready-to-eat (RTE) foods. This is relevant to the FSA's Science, Evidence and Information Strategy for 2015-2020 as the anticipated outputs will contribute to our understanding of AMR and food and also inform the development of risk assessment for AMR associated with the commensal flora present on food which may be derived from food animals, the environment and people.

Whilst AMR is not explicit in the FSA's new strategy for 2015-2020, it does highlight the importance of food being safe and consumers having the right to be protected from an unacceptable level of risk. This could include hazards involving AMR.

A. THE SPECIFICATION

Background

Antimicrobial resistance (AMR) is a global public health concern and relatively little is known about the role of the food chain and how much food contributes to the burden of AMR. The FSA has been working with partners across government to help develop a refreshed AMR strategy including a 20-year vision. Food safety is a component of the new strategy and this will provide an opportunity to highlight the surveillance and research areas needed to improve the scientific evidence base concerning the role of food and AMR.

The FSA is seeking to better understand the way in which different food chain pathways may impact on the presence of AMR bacteria in food, identifying what sources these originated from and what implications their presence in food may have for the transfer of AMR genes to the gut microbiome through dietary exposure.

The FSA is carrying out research and surveillance activities to establish the prevalence of AMR bacteria in retail meats. We are currently in the fourth year of an EU Harmonised Survey on AMR in Retail Meats, which is looking at the presence of ESBL, AmpC and Carbapenemase-producing *E. coli* in fresh retail chicken, beef & pork. Also, the FSA are investigating the presence of AMR as part of the *Campylobacter* whole fresh retail chicken survey. Second year reports for both of these surveys were published in November 2017 and January 2018 respectively.

A recently published FSA-funded systematic review on AMR found that there is a lack of AMR prevalence data in retail foods, and in particular for raw chicken and pork and further surveillance has been undertaken to address this and is expected to be published soon. Other important recommendations include further surveillance to provide data on resistance and multi-drug resistance (MDR) in retail milk and dairy products (butter & cheese), fresh produce (fruit, vegetables & salads) and seafood (fish & shellfish) to several antimicrobials in commensal bacteria.

The FSA is co-funding a five-year Research Fellowship (2017-2022) with the Quadram Institute, Norwich. The Research Fellow is investigating food chain transmission of AMR, the relative contribution of imported vs domestic food and the role of non-pathogenic bacteria in food as an AMR reservoir. Work includes a 1-year sampling of retail food in a defined geographical region, comparison with contemporaneous samples from animals and humans in the same region, over the same period (in collaboration with PHE and APHA), and utilisation of sequencing to evaluate the prevalence, diversity, source attribution etc. of pathogens and AMR. This work is ongoing.

Most of the FSA's surveillance activities have focussed on raw retail meat in the UK. However, there is currently a lack of data concerning the presence and quantification of AMR bacteria in ready-to-eat (RTE) foods and how this relates to consumer exposure in the UK. It is important to obtain AMR data for key RTE foods as these foods do not require any further cooking and/or processing before being consumed and therefore may pose a source of AMR genes in the diet. Work has been done previously on the presence and quantification of AMR genes in soil, food animals and in the human gut (Munk P *et al.*, 2018; Munk P *et al.*, 2017; Noyes NR *et al.*, 2016; Oniciuc EA *et al.*, 2018; Penders J *et al.*, 2013), but there is little or no data available which quantifies the burden of AMR genes present in ready to eat foods. There is also a lack of data to show what happens to these AMR genes in the gut microbiome once consumed, for example are they naturally lost from the body or do they contribute to the spread or accumulation of AMR genes in the human gut microbiome and are there potential health impacts which may be months or years later.

References

EU Harmonised Survey on AMR in Retail Meats:
https://www.food.gov.uk/sites/default/files/eusurvey-amr-retail-meats.pdf

AMR *Campylobacter* Survey in Retail Chicken:
https://www.food.gov.uk/sites/default/files/campylobacter-amr-report.pdf

FSA (2016). A systematic review of AMR bacteria in pork, poultry, dairy products, seafood and fresh produce at UK retail level. https://www.food.gov.uk/research/foodborne-diseases/a-systematic-review-of-amr-bacteria-in-pork-poultry-dairy-products-seafood-and-fresh-produce-at-uk-retail-level

O'Neill, (2014), Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations
https://amr-review.org/

DH, (2013). UK 5 Year Antimicrobial Resistance Strategy 2013 to 2018:
https://www.gov.uk/government/publications/uk-5-year-antimicrobial-resistance-strategy-2013-to-2018

Munk P, *et al.*, (2018) *Abundance and diversity of the faecal resistome in slaughter pigs and broilers in nine European countries.* Nature Microbiology **3:** 898-908

Munk P, *et al.*, (2017) *A sampling and metagenomic sequencing-based methodology for monitoring antimicrobial resistance in swine herds.* Journal of Antimicrobial Chemotherapy **72:** 385-392.

Noyes NR, *et al.*, (2016) *Characterization of the resistome in manure, soil and wastewater from dairy and beef production systems.* Scientific Reports **6:** 24645

Oniciuc EA, *et al.*, (2018) *The present and future of whole genome sequencing (WGS) and whole metagenome sequencing (WMS) for surveillance of antimicrobial resistant microorganisms and antimicrobial resistance genes across the food chain.* Genes **9:** 268

Penders J, *et al.*, (2013) *The human microbiome as a reservoir of antimicrobial resistance.* Frontiers in Microbiology **4:** 87

The Specification

Tenders are invited to carry out research using a metagenomic approach to quantify antimicrobial resistance genes in selected ready-to-eat foods and their likely contribution to AMR in the gut microbiome.

Overview

This proposed study will use a metagenomic approach combined with food intake data to quantify the nature and magnitude of human exposure to drug resistance genes via the consumption of certain ready-to-eat (RTE) foods. The proposed work will compliment other surveillance studies by providing evidence on the magnitude and diversity of resistance genes ingested via certain RTE foods and the important non-pathogen contributors. As such it will contribute to the development of risk assessment for AMR associated with the commensal flora present on food which may be derived from food animals, the environment and people.

The work will focus on commonly consumed RTE foods identified using the latest UK consumption data. This may include meats (e.g. cooked ham, poultry), fresh produce (e.g. lettuce, berries, mushrooms), milk and seafood as examples of typical foods of animal and non-animal origin.

Consideration will need to be given to the DNA extraction and separation of bacterial DNA particularly as most of the DNA present will originate from the food itself. The stringency of metagenomic analysis will need to be considered careful to ensure that there is adequate detection of AMR genes from chromosomal DNA as well as genes on mobile elements including plasmids. Replication of samples will be important to understand the variability in and between samples of different food types and to be able to generate sufficient data to enable robust statistical comparisons to be made. Applicants many also wish to consider using 16S rRNA on a wider range of samples to initially characterise the bacterial flora of the foods prior to a more in depth metagenomic analysis for the AMR genes.

The information delivered by this work is key to supporting the FSA's surveillance work on AMR by identifying the extent of AMR genes found in certain key RTE foods, which will inform risk assessment and provide an indication of which of these should be priority areas. It will also contribute towards assessing the link between antimicrobial use in agriculture and AMR in people acquired via food. It will also enable the FSA to provide more information about the nature and extent of AMR in food which will help support consumer advice.

Details

This research project is not considered to be a survey and therefore the FSA's survey guidelines will not apply.

The key elements of the work are as follows:

1. A short literature review of existing data to look at the AMR population in selected RTE foods and to justify the approach that will be taken.

2. Use of the latest UK consumption data to identify the RTE food categories to be investigated as part of this study. RTE foods that should not be included are composite foods made up of multiple ingredients (e.g. sandwiches, ready meals, herbs, spices etc etc.) as it will be more difficult to pin-point where the AMR genes, if present, originate from. Careful consideration should be given to only including samples representative of the current market sector for these foods and should be labelled products so that the metadata can be captured to compliment the molecular work to be undertaken.

3. Use of 16S rRNA and metagenomic techniques to screen samples of RTE fresh foods at UK retail level for bacteria and AMR traits of interest.
    - Contractor should provide a rationale for the AMR genes selected e.g. those relating to the group of critically important antimicrobials (CIAs) as outlined by the World Health Organisation (WHO), other AMR genes which may be useful for monitoring over time.
    - Provide quantification and statistical comparison of AMR genes in the selected RTE foods where feasible.

4. Extrapolate data against the average UK consumption data for the selected food categories to estimate the number of AMR genes consumed (i.e. intake data).

5. Any caveats in relation to this should be provided.

6. To inform our understanding about the burden of AMR in the RTE foods selected in this study and their likely contribution to AMR in the gut microbiome.

Outcomes

It is anticipated that the following will be delivered to the FSA as part of this work:

- Will provide an important sense check on whether existing AMR targets in food are the right ones.
- Metagenomic approaches generate a vast amount of data and this can be mined to provide additional information.
- Will provide an estimate of the burden of AMR genes ingested via selected RTE foods. This is likely to inform other work assessing the foodborne impact of AMR in the UK and internationally.
- A full technical report addressing the relevant areas of the study which is suitable for publication on the FSA website. The report will need to include a lay summary, executive summary, introduction (including the background and aims/objectives of the research), methodology, findings, discussions, conclusions, references and recommendations for further work. A draft report should be submitted at least four or five weeks before the final report is due to allow FSA officials sufficient time to comment.
- Full details of the data collected in a systemised format and a library of references organised using an appropriate reference management system.
- Provision of a storage facility for the metagenomes i.e. they should be uploaded to an open international database of metagenomic data together with non-confidential metadata relating to the samples (except in the case of brand names).
- Publication of research findings in the peer reviewed literature and presentations at scientific conferences are encouraged by the FSA. Such material will need to be approved by the FSA prior to submission.
- A meeting with FSA officials at Clive House to discuss the key findings and recommendations arising from the research.
- If appropriate to attend a future ACMSF meeting where the project lead will give a presentation on the study findings.

Tenderers should also note that the EU's General Data Protection Regulation (GDPR) entered into force in the UK from the 25th of May 2018. Tenderers are therefore asked to consider what additional measures may need to be taken in order to comply with the new regulatory regime for data protection, and to include in their proposals an explanation of how they intend to implement these measures.

In particular, the processor must: -

- process the personal data only on the documented instructions of the Controller;

- comply with security obligations equivalent to those imposed on the Controller (implementing a level of security for the personal data appropriate to the risk);
- ensure that persons authorised to process the personal data have committed themselves to confidentiality or are under an appropriate statutory obligation of confidentiality;
- only appoint Sub-processors with the Controller's prior specific or general written authorisation, and impose the same minimum terms imposed on it on the Sub-processor; and the original Processor will remain liable to the Controller for the Sub-processor's compliance. The Sub-processor must provide sufficient guarantees to implement appropriate technical and organisational measures to demonstrate compliance. In the case of general written authorisation, Processors must inform Controllers of intended changes in their Sub-processor arrangements;
- make available to the Controller all information necessary to demonstrate compliance with the obligations laid down in Article 28 GDPR and allow for and contribute to audits, including inspections, conducted by the Controller or another auditor mandated by the Controller - and the Processor shall immediately inform the controller if, in its opinion, an instruction infringes GDPR or other EU or member state data protection provisions;
- assist the Controller in carrying out its obligations with regard to requests by data subjects to exercise their rights under chapter III of the GDPR , noting different rights may apply depending on the specific legal basis for the processing activity (and should be clarified by the Controller up-front);
- assist the Controller in ensuring compliance with the obligations to implementing a level of security for the personal data appropriate to the risk, taking into account the nature of processing and the information available to the Processor;
- assist the Controller in ensuring compliance with the obligations to carry out Data Protection Impact Assessments, taking into account the nature of processing and the information available to the Processor; and
- notify the Controller without undue delay after becoming aware of a personal data breach.

Openness:

FSA has values and specific policy on being open and transparent, which includes publishing the full dataset of its research and surveillance studies. Both the lead contractor and their sub-contractors must agree to this openness policy. Any potential issues with this should be highlighted within the proposals.

SCHEDULE 3

SPECIFIC OBLIGATIONS

1. SUPPLIER'S OBLIGATIONS

This Schedule 3 specifies the Ordered Services to be provided to the Client by the Supplier in the services required for FS301050, with reference to their Technical Proposal.

2. CLIENT'S OBLIGATIONS

Notwithstanding the collaboration necessary with the Supplier to enable the provision of Support and Development services, the Client shall be responsible for:

- Reporting incidents as soon as possible, and for providing all relevant information to enable the Supplier to progress resolution of the incident
- Provision of suitable premises and facilities such as desks, chairs, overhead projectors, where appropriate and essential to the delivery of services
- Provision of access to the appropriate equipment and sites to enable the Supplier to undertake specific responsibilities in the supply of Support and Development services

Tender Application form for a project with the Food Standards Agency

Food Standards Agency
food.gov.uk

LEAD APPLICANT'S DETAILS							
Surname	Haynes	**First Name**	Edward	**Initial**	G	**Title**	Dr
Organisation	Fera Science Ltd	**Department**	Detection and Surveillance Technologies				
Street Address	National Agrifood Innovation Campus, Sand Hutton						
Town/City	York	**Country**	UK	**Postcode**	YO41 1LZ		
Telephone No	01904 462515	**E-mail Address**	edward.haynes@fera.co.uk				

Is your organisation is a **small and medium enterprise**. (EU recommendation 2003/361/EC refers http://www.hmrc.gov.uk/manuals/cirdmanual/cird92	Yes		No	x

TENDER SUMMARY	
TENDER TITLE	
What is the burden of antimicrobial resistance genes in selected ready-to-eat foods?	
TENDER REFERENCE	FS301050

PROPOSED START	04/02/2019	PROPOSED	03/02/2021

1: TENDER SUMMARY AND OBJECTIVES

A. TENDER SUMMARY

Please give a brief summary of the proposed work in no more than 400 words.

This project will identify antimicrobial resistance (AMR) genes in a range of ready-to-eat (RTE) foods, provide information on their relative abundance, and estimate the exposure of consumers to AMR genes based on UK consumption data.

Initially a brief literature review will be conducted, to identify existing data on the prevalence of AMR genes in different RTE foods. If suitable, robust data are available on foodstuffs which do not have an AMR gene presence, and those where AMR gene presence is more variable, it will be used to inform the sampling strategy in the remainder of the project. If such data are not available, we will proceed according to our default sampling strategy based on product consumption data.

Samples will be selected from four broad RTE product categories; cooked meats; dairy products; seafood; fresh produce. We will take 1000 samples to represent products that cover around 90% of the total UK consumption within each of the four categories (this may vary between food categories). All samples will be processed by a method to enrich for microbial DNA and reduce host contamination, i.e. rinsing of products, and DNA extraction from rinsate. Extracts will be screened by a metabarcoding approach on the Illumina MiSeq platform (targeting the 16S rRNA gene) to determine suitability for further analysis (based on the presence of bacterial DNA, and the absence or low levels of host contaminant, detectable as sequence attributed to organellar 16S genes). Of these, 256 samples will be sequenced by high throughput, shotgun metagenomics on an Illumina platform. It is currently proposed that these samples will be divided evenly between the product classes (64 in each class), and will be weighted based on consumption data, though this may be amended (with FSA approval) to focus on high risk foods, based on information gathered in the literature review. Approximately 10% of these 256 will constitute repeated samples. Furthermore, we propose to sequence 24 samples on the Oxford Nanopore Technologies PromethION platform. This high throughput long read sequencer will provide additional information on the location of AMR genes ("ARGs") both in terms of the taxonomic identity of their host bacterium, and their genomic proximity to other resistance genes and mobile genetic elements (e.g. plasmids). This may be relevant to assessments of multidrug resistance. Collectively, the short-read and long-read data will be analyzed using complementary approaches to detect ARGs, determine co-location and identify the organisms in which they occur.

B. OBJECTIVES AND RELEVANCE OF THE PROPOSED WORK TO THE FSA TENDER

OBJECTIVES

Please detail how your proposed work can assist the agency in meeting it stated objectives and policy needs. Please number the objectives and add a short description. Please add more lines as necessary.

OBJECTIVE NUMBER	OBJECTIVE DESCRIPTION
01-1	**PROJECT INITIATION MEETING** • Agree timescales for project • Discuss Antimicrobial resistance (AMR) determinants for inclusion in preparation for objective 01-2 • Discuss sample types for inclusion in preparation for objective 01-3 • Identify data sources at FSA that will be available for objective 01-3 and 02-2
01-2	**SHORT LITERATURE REVIEW ON AMR IN SELECTED READY-TO-EAT (RTE) FOODS**
01-3	**DEFINED SAMPLING STRATEGY**
01-4	**COLLECTION OF 1000 SAMPLES OF RTE FOODS**
01-5	**16S METABARCODING SEQUENCING OF 1000 RTE FOOD SAMPLES**
01-6	**SHOTGUN METAGENOMIC SEQUENCING OF A 256 SUBSET OF RTE FOOD SAMPLES**
01-7	**PRODUCE AND SUBMIT YEAR 1 PROGRESS REPORT TO FSA**

02-1	IDENTIFICATION OF AMR GENES IN SHOTGUN METAGENOME DATA
02-2	EXPOSURE MODELLING OF AMR GENE INTAKE IN DIFFERENT RTE FOOD PRODUCT CATEGORIES • Obtain the most recent data available from the National Diet and Nutrition Survey (NDNS) • Estimate dietary intake for the typical consumer within each of the selected product categories, based on the sampled diary records. The categories contributing most to the intake may be identified using results from this step. Uncertainty due to the limited sample sizes should be considered. • Use established statistical models to estimate variation of intake within the population • Identify unquantified uncertainties and discuss any possible impact on the estimates, compared to the true intakes
02-3	PRODUCE AND SUBMIT FINAL REPORT TO FSA
02-4	SUBMISSION OF METAGENOME DATA TO ONLINE, PUBLIC REPOSITORY
02-5	PUBLICATION IN PEER-REVIEWED SCIENTIFIC JOURNAL (WITH FSA AGREEMENT)

2: DESCRIPTION OF APPROACH/SCOPE OF WORK

A. APPROACH/SCOPE OF WORK

Please describe how you will meet our specification and summarise how you will deliver your solution. You must explain the approach for the proposed work. Describe and justify the approach, methodology and study design, where applicable, that will be used to address the specific requirements and realise the objectives outlined above. Where relevant (e.g. for an analytical survey), please also provide details of the sampling plan.

Antimicrobial Resistance (AMR) is increasingly recognised as a vitally important, global public health concern (O'Neill, 2014), potentially causing untreatable infectious diseases and making recent medical advances (e.g. chemotherapy, organ transplant) unusable. This is especially important when considering the emergence of resistance to so called critically important antimicrobials (CIAs) (e.g. Liu et al., 2016), which can be the last line of defence against bacteria already resistant to frontline antibiotics. The use of antimicrobials in the agrifood chain is known to lead to the evolution of AMR, which may be transmitted to human pathogens or the human commensal microbiota (Hudson et al., 2017, van Bunnik and Woolhouse, 2017).

An evidence gap exists about the extent to which consumption of foodstuffs contributes to AMR in the human microbiome, especially for ready-to-eat products. These products are of particular interest, as they are consumed without further cooking in the home, implying that any AMR bacteria (or intact AMR genes) present could contribute to AMR in the microbiome of the consumer. They also span a range of production techniques which may differ in the extent to which they promote the evolution of AMR, based on differing antimicrobial inputs during production. This project will begin to address that evidence gap. We will sample 1000 products from a variety of RTE food categories (cooked meats; dairy products; seafood; fresh produce), weighted by consumption data and any available evidence on AMR prevalence. We will assess these samples for suitability for further investigation using a metabarcoding screen, to identify samples with sufficient bacterial DNA to proceed to metagenomic sequencing. Of the samples that pass the thresholds (to be developed during the project) a subset 256 samples will be selected for metagenomic sequencing, based on the product category divisions (64 samples in each product category), and the most commonly consumed samples within them. The metagenomic data will be used to identify the presence of AMR genes, regardless of the bacteria (pathogen or commensal) which contain them, and this information will allow estimates to be made about the relative exposure to AMR genes in different food categories. This will provide important insights into the fitness for purpose of existing AMR targets for surveillance and contribute to FSA's mission to ensure food is safe to eat. In recent years, metagenomic approaches have provided a wealth of AMR data from other areas of food production, but very few studies have been performed on the metagenome of RTE foods in any context.

OBJECTIVE 01-1: PROJECT INITIATION MEETING

A face-to-face meeting is planned for February 2019 with FSA. This will be an opportunity for Fera to gain FSA steer on any AMR determinants of specific interest, which could be included as a focus of the literature review (objective 01-2). Additional FSA insight on our approach to developing a sampling strategy (objective 01-3) would be gratefully received. Of importance will be a discussion on potential sources of information to develop from our sampling strategy an implementable list of samples to be taken. This could include access to comprehensive lists or databases of retailers from whom samples can be obtained.

OBJECTIVE 01-2: SHORT LITERATURE REVIEW ON AMR IN SELECTED READY-TO-EAT (RTE) FOODS

We do not propose to undertake a systematic review of the literature on AMR in foodstuffs, as extensive reviews have been undertaken recently (e.g. FSA projects FS102127 and FS301027, Hudson et al., 2017). Instead, we will use the relevant data identified in these reviews, and any more recent, relevant publications (especially involving metagenomic approaches, of which thus far there has been a dearth relating to RTE foods) to identify any quantitative information on the distribution of AMR genes (or phenotypically determined AMR bacterial isolates) which can inform the foodstuffs to be sampled in the sampling strategy (objective 01-3). A list of references included in the literature review will be provided to FSA, for example in the form of an EndNote library.

OBJECTIVE 01-3: DEFINED SAMPLING STRATEGY

The measures of the presence of AMR genes that will be undertaken in this project are:

- proportion of samples that contain AMR genes,
- average number of different AMR genes per sample
- distribution of numbers of different AMR genes per sample across samples
- relative abundance of different AMR genes

We propose to take approximately 1000 Ready to Eat Food samples, of which we will test a total of 256 samples for the presence of AMR genes (256-sample selection will be determined by the results of our initial microbial screen; objective 01-5).

The default sampling strategy is based on the principle that, "For a study made up of different sample types, and where the variation in the measure of interest is expected to be equal between sample types (or where it may vary between sample types, but we have no information about where the variation may be larger), then the minimum expected uncertainty in the average or total of the measure of interest for the population is achieved where the proportion of each sample type in the study is equal to the proportion of each sample type in the population."

A large number of sample types encompass "Ready to Eat Foods", more than 2000 in the most recent National Diet and Nutrition Survey (NDNS). Given the number of samples that can be tested at a reasonable cost, we do not propose to determine the presence of the quantity of AMR genes in *all* RTE food types. Instead we will divide RTE food into four main categories: cooked meats, dairy products, seafood and fresh produce. We will then take samples to represent products that cover at least a target percentile of the total consumption within each of the four categories. Our current aim is at least 90%, though this may vary depending on the category.

There will be 64 samples available within each of the four categories. Samples of each food type will be in proportion to the consumption of that food type within the category, subject to a minimum of five samples per food type.

This design will provide data that can be used to estimate the AMR burden associated with different patterns of consumption of food between the four categories, including consumption of an "average diet" (based on NDNS consumption data, and decided according to the precise requirements of the risk assessment) and also provide useful information of how AMR presence may be expected to vary within and between food types.

If robust data on the presence of AMR genes in certain RTE foods is available (objective 01-2) then we may modify the primary 1000-sample plan to avoid foods where the presence of AMR genes is known to be low, while including them in estimates of consumption of AMR with a zero value.
An alternative approach whereby samples are taken strictly in accordance with consumption information could be applied. The mean measures of AMR presence in such a sample could be expected to represent the mean AMR presence in an average diet. But, because it is likely that many food types in this kind of approach may be represented by a single sample it will be difficult to estimate any measures of uncertainty about the mean consumption of AMR, and information that may be useful in the design of further studies may not be captured.
As part of the internal review process, which includes consultation with the FSA, the sampling strategy may be modified if it does not adequately represent the general population diet or the diets of important high-risk subpopulations.

In addition to the samples proposed above, we also plan to take a small number of samples of less commonly consumed foodstuffs and create four combined samples (one for each broad product category), which will then form part of our 256 samples. This will provide qualitative information about whether unusual and interesting AMR determinants are present in these more rarely-eaten foods and may inform future sampling efforts.

The breakdown of product types to be sampled from the four product categories (ready-to-eat meats, dairy, seafood and fresh produce) will be combined with information on UK retailer locations (objective 01-1) into a list of specific samples to be acquired. This will be undertaken by the subcontractor (HallMark Veterinary and Compliance Services).

OBJECTIVE 01-4: COLLECTION OF 1000 SAMPLES OF RTE FOODS

Sampling will be subcontracted out to HallMark Veterinary and Compliance Services.

Proposed Sampling Methodology and justification of the approach

Preparation (prior to sample collection)
HallMark has systems to provide equipment nationally and will supply all essential and necessary equipment for the provision of the service. HallMark will ensure that purchased products conform to the expected requirements and quantity. We only use approved and effective suppliers such as Icertech. HallMark store and send out sampling equipment centrally. Sampling equipment confirmation receipt is required from the collectors at least one week before sampling commences. Collectors receive an equipment form and need to check the delivered equipment against that form. Collectors then confirm receipt or non-delivery of the equipment and documents to the sampling operations team. Any left-over consumables and equipment are to be recycled or reused on a different project.

Equipment
Each Collector shall ensure they have the following items to be used for collection of samples:
Table: Sampling Kit Unit Summary

Item	Use	Supplied by	Image
Cool box and ice elements	To keep samples cooled during transport, before final packing	Collector's own	

Grip seal clear polythene bags	To contain 1 sample per bag to prevent cross-contamination; then placed into a tamperproof sample bag with unique sample number	Supplied centrally by Hallmark	
Tamperproof sample bag with unique number	To contain 1 sample (which is already contained in a clear grip seal bag)	Supplied centrally by Hallmark	
Sharpie Permanent Marker	To write Shipping details	Supplied centrally by Hallmark	
Self-adhesive Document Wallets (to contain the laboratory submission letter)	The self-adhesive pouches serve as shipping labels, with the address of the laboratory showing through the clear polythene.	Supplied centrally by Hallmark	
Sample Protection Material such as bubble wrap, loose packing peanuts, recycled shredded paper etc.	To protect samples from getting damaged inside the consignment box.	Some bubble wrap supplied by Hall Mark. Collectors are required to recycle any other protection materials, too.	
Ice-Pads	Submerge in water until plump. Place in freezer 6-8 hours before use.	Supplied centrally by Hallmark	
Icertech Insulation boxes and Icertech chill packs	For temperature-controlled sample packing See Support Document *HallMark Section 2.A Icertech General Performance Summary Feb 2017*	Supplied centrally by Hallmark	
Packaging Tape	To seal the consignment box for dispatch.	Supplied centrally by Hallmark	

Infrared Thermometer, Eventek IR Laser Thermometer, Non-Contact Digital Temperature Gun - 50°C~380°C (-58°F~716°F)	To check and record the surface temperature of the sample prior to purchase	Supplied centrally by Hallmark	

We have carefully selected the use of the above equipment as in our opinion, it delivers cost effective consumables as well as efficient and proven performance.

Sampling Documents
The following sampling documents will be supplied to each Collector and used in the collection process:

Sampling Document	Description
Sampling Instructions Document.	This provides information for the Collector, including the clearly defined methodology to follow. Collectors must follow the correct procedure for the collection of samples, as described in this document.
Sampling Steps Checklist.	Laminated tick list containing all important sampling steps to aid with the sampling methodology.
Sample Request Form (known as the weekly shopping list)	This contains weekly sampling information such as type and numbers of samples, retailer(s) group, region; purchase location number etc.
Online Data Collection Form	Required for sample logging and to report data back to HallMark Operations Team and the selected lab (s). Almost any web browser, including mobile smartphone and tablet browsers, can be used to access the HallMark Sampling systems (HMSS)
FSA Notification Leaflet	To notify small retailers at the time of purchase.
Laboratory submission letter Document	To send with batch of collected samples to the laboratory.
Shipping labels	Self-adhesive Document Wallets: the self-adhesive pouches serve a double purpose as shipping labels and contain relevant documents/information, with the address of the Laboratories showing through the clear polythene Courier labels Packages must be clearly labelled "PERISHABLE"

Sample Request Notification
HallMark Operations Team will assign collections to Collectors each week using the HallMark Sampling System (HMSS).
The Sample Request Form or Shopping lists are downloaded by the collectors from the HMSS data system online.

The shopping list contains

- The list and numbers of samples to be obtained each week
- Region; purchase location number and name
- Food Category to be purchased
- Further detail on description/purchasing instructions
- Advice for the selection of a specific product within the retailer

- Storage Temperature requirements at laboratory (i.e. chilled)
- Packing Requirements
- Laboratory delivery address

Retail Sampling Process

- Collector will consult shopping list and organise collections for that week.
- The surface temperature of the sample will be checked and recorded prior to purchase. This is achieved by using the calibrated infrared thermometer supplied.
- Samples are placed inside a large, sterile, grip sealed bag in order to ensure cross contamination with other samples, hands and surfaces is avoided. (See cross contamination precautions section below)
- For 'Small Retail Outlets', Collectors will issue a leaflet from the FSA to inform them at the time of purchase that samples have been taken from their establishment for research purposes. The leaflet will be issued after purchase to avoid outlet owner's participation issues, where they may be reluctant to allow purchasing of the sample(s). Hard copies of the FSA Notification Leaflet are supplied centrally by HallMark Operations Team together with the other documentation and the relevant equipment.
- Collectors do not need to provide the FSA Notification leaflet to 'large retail outlets' or chains. HallMark Operations Team will notify large retailer's headquarters, rather than providing a letter to the individual store manager at the time of purchase.
- Photographs are to be taken before the samples are packed and dispatched to Fera, which shall include the unique sample number. Photographs taken by the Collectors are uploaded in the HallMark Sampling System (HMSS). Access will be given to Fera. Any photographs taken outside the laboratory environment will be taken with the sample inside the transparent large grip seal bag to avoid cross contamination.
- The bag containing the sample will be placed inside a numbered tamperproof sample bag and sealed. This provides the identification of each sample collected including sequential numbering and barcoding (unique sample number), plus a tear-off receipt at the top of the bag which carries the same number as the bag. The number must be quoted in any correspondence about the sample. Once sealed, the bag will not be opened until the sample has reached the Fera laboratory.
- Samples will be kept chilled from the time of sampling until delivery to the laboratory. This is achieved by storing samples inside the Insulated Shipping Box provided containing gel freezer packs and/or ice strips. Gel freezer packs are placed in a freezer at least 48 hours before sampling and are held frozen until use. Freezer packs are kept away from direct contact with the samples using polystyrene dividers and bubble wrap. Bubble wrap is also used to secure the samples in the box when loose.
- Correct packaging and temperature control is paramount; temperature and package integrity will be checked and recorded on arrival at the laboratory.
- Insulated Shipping Boxes are to be closed securely. It is important that a box is not left open or closed without gel freezer packs for any length of time as this may damage the sample. Packaging tape is used to seal the consignment box for dispatch.
- Once sealed, an adhesive address label (provided) is attached to the outer carton across the sealed joint.
- The sealed consignment box is finally placed in a cool area/cool room and away from direct sun light/heat until dispatch is arranged. Samples must reach the Fera laboratory within 24 hours of purchase.
- A laboratory submission letter is completed for each box consignment and placed in the self-adhesive document wallet adhered to the consignment box. The number of samples in a consignment box will correlate with the number entered on the form. The self-adhesive transparent document wallet is adhered to the outer surface of each consignment box and acts as an address label for Fera.
- Samples will be dispatched to the Fera from Monday to Tuesday only, avoiding bank holidays and public holidays, so the samples do not arrive outside of laboratory hours. Samples will only be dispatched on Wednesdays or Thursdays for contingency purposes. Samples will be purchased early in the day, so they can be sent on the same day to the laboratory.
- Samples will be delivered to the laboratory with a target of a maximum of 24 hours from purchase. To achieve this, we use Parcel Force Express AM service which guarantees delivery before 12pm the following day. Individual parcels can weigh up to 30kg and there is

no weight limit for a consignment of multiple parcels. This service offers excellent flexibility around collection, including collection from a stated location, a local Post Office or a Parcel Force depot. Delivery covers the majority of UK destinations, is fully tracked, and requires an electronic signature. Delivery Time is guaranteed, and insurance is included. Initial research indicates that the service is cost efficient, highly reliable and guaranteed, thus, for the purposes of this Invitation to tender financial pricing we have estimated the pricing based on the use of this service.

Cross-Contamination Precautions
It is essential that cross-contamination is avoided during the retail sampling process. Precautions will therefore be taken at all stages to ensure that the equipment used during sampling, transport and storage is not contaminated by other samples collected for the project. Briefly, a single sample from the selected retailer is to be collected and placed into one of the large grip seal bags, sealed and then placed into a second numbered large tamperproof sample bag and sealed. The samples are to be packed into the chilled Insulated Shipping Box and sent to the selected laboratory for testing.

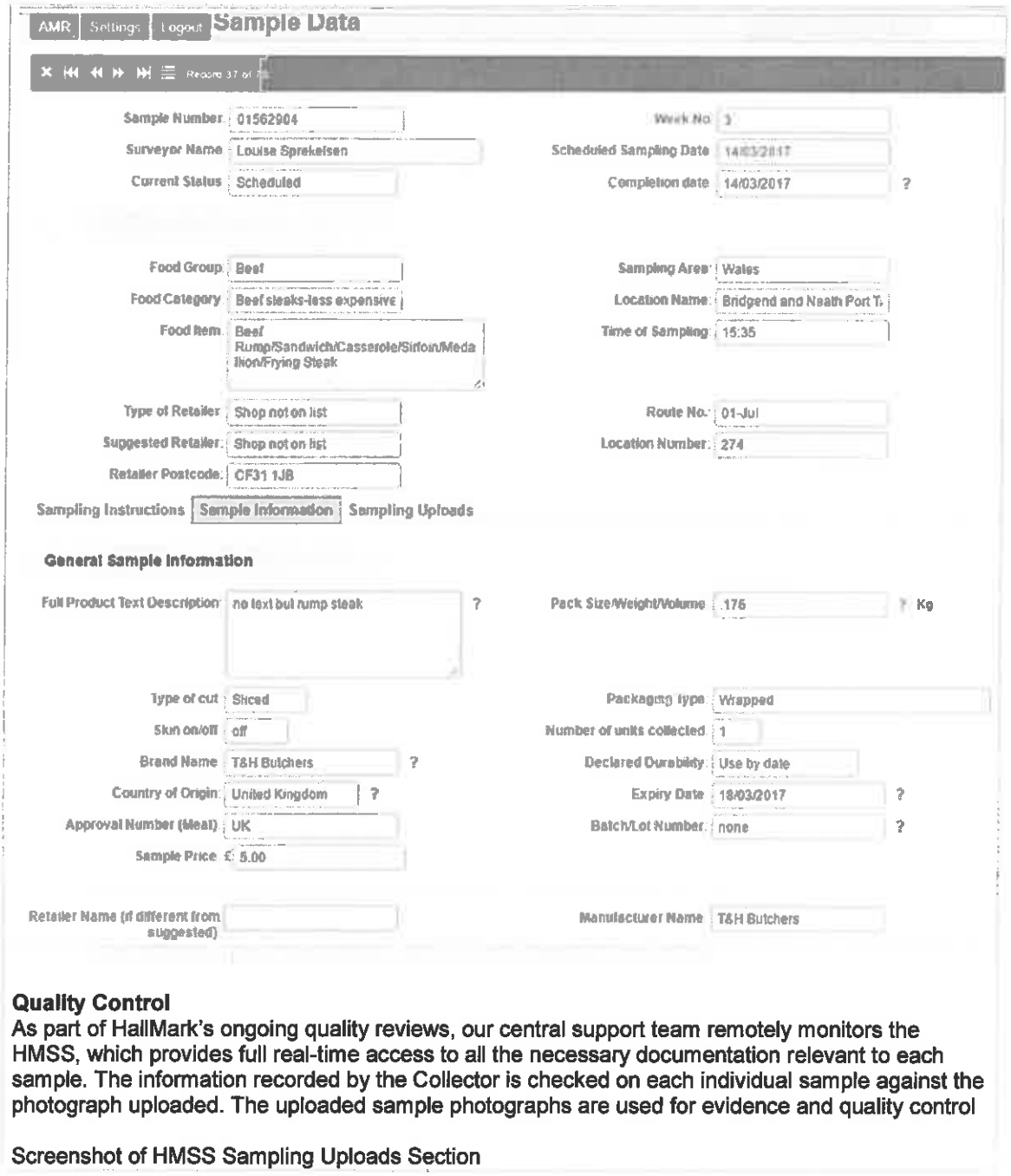
Collectors will take the following steps to ensure avoidance of cross contamination:

- Each sample will be kept separate from other samples on the same day of collection at all times
- Handling, wrapping and packing of one sample at a time
- Each sample will be placed into a separate large grip seal bag, which will be sealed immediately to avoid the risk of cross-contamination until testing can take place
- Not re-using sampling equipment unless disinfected by the lab (to be agreed with the lab).

Data Collection of Sample Information & reporting Data to HallMark and Laboratories
Collectors are required to record a high level of detailed information about samples collected in accordance with the agreed protocols. The data acquired ensures traceability of the samples.

All sample data should be logged into HallMark Sampling System (HMSS). Required information includes unique sample Number; Date/time of purchase; display temperature, Brand name (if any); Product description; Weight/volume of each sample purchase and number of units purchased to make sample size; Manufacturer name; Retailer name, address and post code; Country of origin; Durability; Batch code/lot; Approval Number (if available); Form of packaging; date and time of purchase; date/time of delivery of sample to laboratory; Sample price etc.

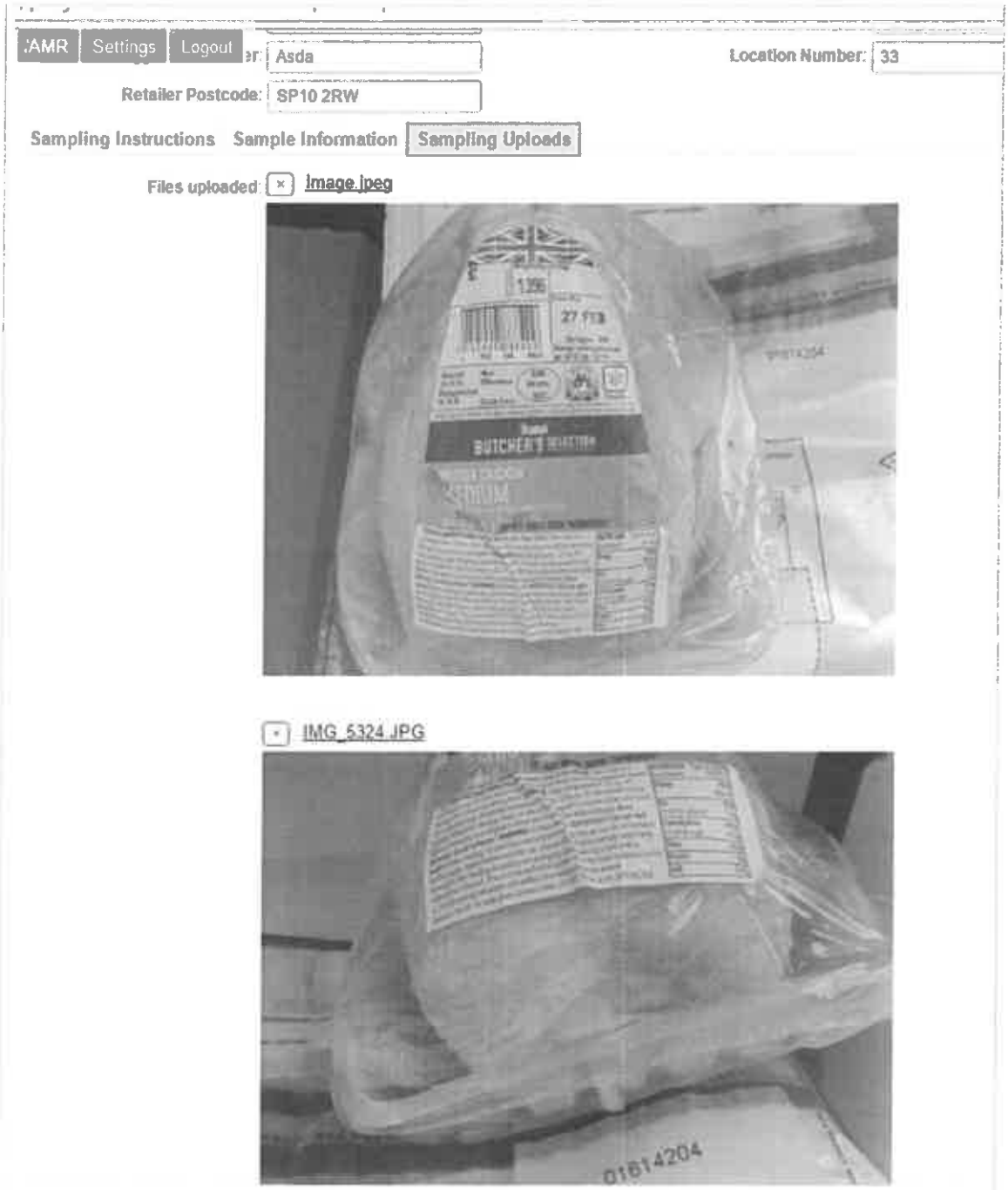
Screenshot of the HallMark Sampling System (HMSS)



Quality Control

As part of HallMark's ongoing quality reviews, our central support team remotely monitors the HMSS, which provides full real-time access to all the necessary documentation relevant to each sample. The information recorded by the Collector is checked on each individual sample against the photograph uploaded. The uploaded sample photographs are used for evidence and quality control

Screenshot of HMSS Sampling Uploads Section



Data Transfer to Laboratories
The HMSS allows the transfer of data and reporting to multiple Laboratories (where required). Individual Laboratories will be able to have their own log-in details and have access to the samples relevant to them. This data is live as it is entered onto the system, allowing for real-time tracking of the sampling process. In addition, it is the best solution for the management of data spreadsheets - eliminating the need for version control.

Testing and Laboratories Feedback
On receipt of the samples, Laboratories will check:

- The information recorded by the Collector
- The packaging of the sample is intact before testing. If packaging has been damaged during transportation this should be noted

- The temperature of the samples will also be recorded on receipt; those at temperatures above 8 will not be tested.

The laboratory needs to notify HallMark of any rejected samples, preferably via the HMSS. Following laboratory feedback, if further sampling is considered necessary, then the HallMark Operations Team will make appropriate arrangements with the Collector(s). Laboratories will access HMSS and confirm acceptance of the samples to the Collector and HallMark Operations Team.

Objective 01-5: 16S METABARCODING SEQUENCING OF 1000 RTE FOOD SAMPLES

We propose to screen all 1000 RTE food samples collected using a 16S metabarcoding approach, before deciding on a subset of 256 of these samples to take forward for shotgun metagenomic sequencing. 16S metabarcoding involves DNA extraction, PCR using conserved primers targeting the 16S rRNA gene, sequencing using a High Throughput Sequencing (HTS) platform, and assignment of sequences to taxa. This will provide information about two important factors to consider when selecting samples for shotgun metagenomic sequencing. Firstly, it will identify samples which have sufficient DNA of bacterial origin to identify bacterial communities from 16S data. It is assumed that these samples will also have sufficient DNA to identify bacterial communities, and the genes that they carry, from metagenomic sequencing. These samples will be taken forward for consideration for metagenomic sequencing. Secondly, 16S metabarcoding will identify samples for which extracted DNA is comprised primarily of host DNA, in this case originating from the organism comprising the sampled foodstuff. We know that in samples where large amounts of host DNA from plants or animals is present, 16S metabarcoding using standard primers (outlined below) amplifies regions associated with host organelles (Lewis et al., manuscript in preparation). Samples associated with a rich and diverse microbial community are indicative of suitability for metagenomics sequencing, whereas those dominated by host DNA are likely to have very narrow community structure (consisting for example of mostly chloroplast/cyanobacteria signature sequences).

We do not propose to use the bacterial taxa identified to select samples for metagenomic sequencing, beyond the criteria described above. This is because 1) we wish the metagenomic sequencing and exposure modelling analysis to be conducted on a selection of samples representative of their product type, regardless of whether they are dominated by a particular bacterial population, and 2) antimicrobial resistance genes are frequently transferred between bacterial taxa on mobile genetic elements (e.g. plasmids). It is therefore possible that two samples with similar taxa identified by 16S metabarcoding will have quite different AMR determinants present.

DNA extraction

DNA extraction will be performed in Fera's High Throughput Sequencing (HTS) sample preparation suite. Work is carried out in isolation from other projects and samples, under forensics standard conditions (Annex 1) to prevent sample cross-contamination. DNA extraction will be performed on buffer rinsates of the samples collected. This will enable bacteria to be removed from the product surface with the minimum contamination with host DNA from the sample product. Rinsates will then be centrifuged to pellet bacterial cells and extracted using an appropriate methodology (e.g. Qiagen DNA Mini Kit) with appropriate negative controls. Methods do exist for enrichment of prokaryotic DNA over eukaryotic DNA (based, for example on differential patterns of methylation). These can be trialled during this project, but their effectiveness is uncertain, especially in such varied matrices, and therefore we propose to rely primarily on the extraction of rinsates for the reduction of host background.

There are some product types for which this may be unfeasible (e.g. liquid samples, such as milk). If objective 01-3 identifies any liquid product types which must be sampled, we will determine an appropriate extraction methodology which will allow sufficient bacterial DNA to be extracted. For example, for milk we currently use the Qiagen DNeasy® PowerFood® Microbial Kit.

There are several examples from the scientific literature of taxonomic bias associated with different extraction methodology (Kennedy *et al.* (2014); Burbach et al. (2015); Brandt and Albertsen (2018);

Hallmaier-Wacker et al. (2018)). We do propose to use only a single extraction methodology on product rinsate samples, which will likely be the Qiagen DNA Mini protocol, a commercial kit-based extraction method with which we have extensive experience. However, as described above there are likely to be a small number of liquid sample types (e.g. milk) which cannot undergo the rinsing protocol. In this instance, if possible, we will use the same extraction method as for the rinsates, but on a bulk product sample. If this is unfeasible due to specific product characteristics (e.g. high fat, high sugar) and a more product-specific extraction protocol becomes necessary, then the bias between extraction methods will have to be accepted, and any implications acknowledged in the project report.

For some types of fresh produce, it is suspected that bacteria can internalise in the leaf surface through roots, and translocate to other parts of the plant (Solomon et al., 2002). It is not known how frequently this occurs in the field, but some evidence suggests this occurs at low frequency at the bacterial loads found in the real world (Johannessen et al., 2005, Zhang et al., 2009). Given the assumed low frequency of internalisation, and the low amount of bacterial DNA that can be sequenced from a whole sample extraction from produce, we consider a rinsate extraction an acceptable trade-off.

A culture-based enrichment approach followed by metagenomics (e.g. Hyeon et al., 2018) is deemed inappropriate for this project. Culture-based enrichment must necessarily be targeted at one or a few taxa, at the expense of other taxa with different culture conditions, which would strongly bias against recovery of AMR gene sequence from non-enriched taxa. Additionally, dead cells or free DNA will be biased against during a culture-based enrichment. However, if AMR gene DNA remains intact under these circumstances, it is possible that it may contribute to the AMR profile of the host microbiome after ingestion (via uptake into competent cells, e.g. through transformation).

To avoid sample degradation during storage, samples will undergo DNA extraction in batches upon receipt. DNA will be stored at -30°C prior to library preparation. After rinsing, samples will be retained at -30°C until the end of the project.

Library Preparation and Sequencing

PCR and library preparation will also be carried out in Fera's HTS sample preparation suite. This project will target the 16S rRNA gene, a commonly used barcoding gene for bacterial populations. All samples will be sequenced on the illumina MiSeq. This is a widely-used sequencer, on which the majority of Fera's HTS takes place. The MiSeq produces large amounts of very accurate DNA sequence, e.g. 22-25 million reads, with >70% bases higher than a Q30 phred score (i.e. 1 in 1000 probability of an incorrect base call) (illumina, 2018). This project will use primers designed to amplify a small fragment of the V4 variable region of the 16S gene (Caporaso et al., 2011, Caporaso et al., 2012, Parada et al., 2015, Apprill et al., 2015, Walters et al., 2016). Amplified PCR products will be prepared for sequencing according to our internal SOPs (Annex 2, derived from the Illumina application note "16S Metagenomic Sequencing Library Preparation"), with each sample being tagged with indexes in an additional PCR reaction to allow multiplexing of samples on a single run. Tagged, multiplexed samples will then be sequenced on the illumina MiSeq using the MiSeq reagent kit V3.

Analysis

For analysis of metabarcoding sequence data, our software of choice is the QIIME2 platform (Caporaso et al, 2018), which has the advantages of being open-source, very widely used and well supported by developers. It is versatile, mostly employing a choice of third-party software for each analysis stage. We will use it to perform quality control procedures, employing standard methods for each stage, including: detection and removal of primer and any contaminant adapter sequences, joining of paired-end reads, quality-trimming of reads, denoising (detecting and correcting probable mis-called bases), chimera-detection and length-filtering. Using QIIME2 we will then apply the dedicated tools/database to the 16S amplicon data to produce a general characterization of the taxa present and the community diversity, in order to categorize the samples in terms of suitability for metagenomics.

OBJECTIVE 01-6: SHOTGUN METAGENOMIC SEQUENCING OF A 256 SAMPLE SUBSET OF RTE FOOD SAMPLES

Sample selection

As we have no *a priori* information about what constitutes an acceptable level of host organellar DNA in a sample, and a sufficient level of bacterial DNA, thresholds will be determined during the analysis of the metabarcoding data (objective 01-5). Samples which do not exceed or fall short of the developed thresholds will form the sample set from which the 256 samples for shotgun metagenomic sequencing will be selected. The final 256 samples will be decided upon, based on the product category divisions (64 samples in each product category), and the most commonly consumed samples within them (as determined during objective 01-3). Of these 256 samples, approximately 9% (24 samples) will be repeated samples, which will be repeat instances of the same food product from the same batch, location and time, to investigate variation due to other factors. The remaining DNA extracts, up to 744 depending on how many of the metabarcoding samples pass the developed thresholds, will be stored at -30°C, for potential future investigation.

Library Preparation and Sequencing

Library preparation will again be carried out in Fera's HTS sample preparation suite. We propose to use the Illumina TruSeq DNA Nano kit, and sequence the samples on a HiSeq 3000 or higher, to achieve an average sequencing depth of 25 million reads per sample (this is of the same order as used in contemporary ARG-detection studies in other parts of the agri-food chain, e.g. Noyes et al., 2016, Munk et al., 2018). The sequencing of the libraries (prepared at Fera) will be subcontracted out. The TruSeq DNA Nano kit is appropriate for two reasons. Firstly, it contains a PCR step that enables library generation from low levels of input DNA, which may be the case with rinsates from products which have been produced and treated in accordance with HACCP (Hazard Analysis and Critical Control Point) procedures. Secondly, the PCR step has been shown to reduce the level of index hopping (i.e. swapping of index oligonucleotide tags on a DNA fragment, leading to mis-assignment of sequences to the incorrect sample) seen between multiplexed samples (illumina, 2017).

Index hopping is an extremely important consideration, as all of the most recent high throughput Illumina sequencing platforms utilize patterned flow cells for sequencing. These flow cells have a specific technology (ExAmp chemistry) associated with high levels of index hopping (Costello et al., 2018), rendering them unusable for metagenomic applications without appropriate remediation. The TruSeq DNA Nano protocol, along with the use of the illumina Free Adapter Blocking Reagent (a proprietary reagent used to remove free index oligonucleotides, which are another cause of index hopping) should reduce the levels of index hopping. Additionally, we will use Unique Dual indexes, rather than Combinatorial Dual indexes, to unambiguously identify and then bioinformatically remove index hopped sequences. Indexes work on the basis that each DNA fragment is tagged with two different index oligonucleotides, allowing samples to be multiplexed, and sequences then assigned to the correct sample based on their index sequences. With more conventional, combinatorial dual indexes, it is the unique combination of two different indexes that identifies a sequence to a sample. However, each of these indexes may be used in combination with multiple other indexes, to tag different samples. If a DNA fragment undergoes index hopping, and the new index is from a legitimate index combination used for another sample, there is no way of determining that sequence's true origin. Unique dual indexes work on the basis that each index will only be found in combination with one other index. If index hopping does occur, it will almost certainly be to an index combination which is invalid (i.e. not used during this sequencing run), and this sequence can be removed bioinformatically (Costello et al., 2018). Theoretically a DNA fragment could undergo index hopping at both indexes, resulting in a valid combination assigned to another sample. However, the likelihood of this happening is very remote.

PromethION sequencing of 24 samples

As part of this project we propose to sequence a subset of 24 samples on the Oxford Nanopore Technologies (ONT) PromethION platform. The specific samples to be sequenced are yet to be determined and will be comprised of samples of particular interest based on the metabarcoding screen, the initial ARG results from the illumina sequencing, and potentially from products of

particular interest to FSA. The PromethION is a high throughput, benchtop sequencer capable of producing more than 50 Gigabases of data per flow cell (https://nanoporetech.com/products/promethion), up to five times as much data as the more portable and widely available ONT MinION (https://nanoporetech.com/products/minion). Most importantly, ONT sequencers are capable of producing extremely long sequence reads, essentially as long as the input DNA fragment and potentially megabases long (Payne et al., 2018). This high throughput long read sequencer will enable genes to be sequenced in their genomic context, for example enabling the coinheritance of multiple resistance genes on a single mobile element (e.g. plasmids) to be detected. Furthermore, as a single long read is much more likely to cover both AMR gene/s and taxonomically informative regions, the use of long reads will likely provide additional information about the identity of bacteria carrying AMR genes. However, the sole use of the PromethION for all metagenomic samples would be inappropriate; it is currently still in Beta release and has a much higher error rate than the proven Illumina technology. Therefore, we present its use here as a pilot study, with the potential to add a considerable amount of information without risk to the project.

OBJECTIVE 01-7: PRODUCE AND SUBMIT YEAR 1 PROGRESS REPORT TO FSA

First year report will provide FSA with overview of progress to date, including summaries on;

- Products sampled
- Taxonomic data from metabarcoding sequencing
- Progress on metagenomic sequencing (HiSeq and PromethION), and sequencing statistics from these samples

After submission and review, first year progress report can be discussed in person, or by teleconference, as preferred by FSA.

OBJECTIVE 02-1: IDENTIFICATION OF AMR GENES IN SHOTGUN METAGENOME DATA

Quality-control and host-DNA filtering

We will use standard tools for joining paired-end reads, quality trimming and filtering by minimum length. For host screening, we will prepare databases of genome sequences of relevant plants (including close relatives where specific host complete genomes are unavailable), livestock, and human. Reads which map to these with a tool such as BWA-MEM (Li and Durbin, 2009) will be discarded.

We will employ several different complementary approaches to identify ARGs in the metagenomic data, as follows.

Analysis of unassembled short reads (Illumina)

(i) ***Mapping to reference ARG sequences.*** Contemporary studies use one of several mapping tools to match reads to one of several databases (typically containing several thousand ARG sequences). Typically, this requires a very high threshold for sequence identity, in order to avoid false positives (since some types of ARG belong to superfamilies whose members are not necessarily all ARGs). One drawback of this is that a relatively high rate of false negatives is likely, but it represents a useful conservative approach. We will employ this method (using a tool such as BWA-MEM) in order to obtain count data for identified ARGs, which will be regarded as high-confidence hits. **Reference ARG database:** Although the number of available databases is increasing, many of the recent ones are derivatives or non-redundant hybrids of well-established databases - often, founded on the Comprehensive Antibiotic Resistance Database (CARD) (Jia et al., 2017). We will review prior to data analysis, but current likely candidates are MEGARes (Lakin et al., 2017) (contains around 4,000 ARG sequences) and DeepARG-DB (Arango-Argoty et al., 2018) (see below). (We do not propose to investigate genes conferring resistance to antimicrobials besides antibiotics; however, if this were a requirement we can also make use of dedicated data resources such as the BacMet database (Pal et al., 2013).

(ii) ***Use of dedicated ARG-detection software.*** Recently, an ARG-detection tool has been published (DeepARG; Arango-Argoty et al., 2018), which has been trained using "deep learning" techniques to detect new ARG sequences (in known classes) that do not necessarily have very high similarity to known ARGs – that is, to reduce the false-negative rate. We will use the version of this tool (DeepARG-SS) dedicated to analysing short reads. This software is associated with a new database (DeepARG-DB, containing 15,000 sequences) (essentially, a hybrid of existing databases). It is possible to update this database and retrain the software if necessary. Reads identified as ARGs which diverge considerably from 'gold standard' ARG sequences (in CARD) will therefore be expected to represent more sensitive ARG-identification, but we will nonetheless mark these as putative. We note that a number of other ARG-detection tools exist, but most of these are based on mapping or sequence-similarity search software (such as BLAST), using a database similar to the above. As a sense check, we will compare the DeepARG-SS hits (frequencies of each ARG) with those from approach (i), expecting that the hits from the mapping approach should essentially be a subset of the machine-learning method's hits.

(iii) ***Species/strain-level identification*** using MetaPhlAn2 (Truong et al., 2015) and StrainPhlAn (Truong et al., 2017). These tools use provided databases of species marker genes to identify organisms (from several domains of life) to as fine a resolution as possible. This will act as a sense check regarding, for example, known ARGs associated with particular bacterial groups, which are found to be present in the samples. In general, this will provide species-level identification (and indicate proportional abundances) but StrainPhlAn results will highlight evidence of strains which may be specific to different types of food. These methods rely on reads which match the markers – most or all of these are not ARGs and so these do not provide direct evidence of which ARGs the species/strains are associated with.

Analysis of long reads (Nanopore)

We anticipate that many reads will be kilobases in length, in a long-tailed distribution which will include small frequencies of reads tens to hundreds of kilobases. A great strength of long-read sequencing is that it enables more reliable detection of known sequences (such as ARGs), compared to the fragmented nature of short-reads.

(i) We will compare the Nanopore reads with the ARG database sequences (see above), noting cases of co-occurrence on one read.
(ii) We will apply the *long-read* variant of DeepARG (DeepARG-LS), or suitable alternative, to these reads.
(iii) As a supplementary analysis, we will annotate reads exceeding a threshold length using PROKKA (Seemann, 2014), and identify mobile DNA elements (plasmids) using resources such as ISfinder (Siguier et al., 2006) and ACLAME (Leplae et al., 2010). This will provide a useful resource for future investigation. For example, long reads can be used as input to the latter stages of the MetaCompare analysis software (Oh et al., 2018) which assesses risk from resistomes due to such co-occurrences.
(iv) There are uncertainties in the precise length and error distribution of the Nanopore platform. In order to gain insights into error rates and relative abundance data, we will map the short reads to the long reads (using e.g. BWA). Potentially, in combination with the annotation in (iii), this will enable future analysis of frequencies of co-location of ARGs with other ARGs and associated genes.
(v) Long reads also afford the opportunity of identifying the species/strain of origin of identified ARGs, and potentially the plasmids involved. This would provide direct statistics of the incidence of specific ARGs associated with particular species/strains, among these long reads. Relative incidence of commensal and pathogenic taxa will be of particular interest.

Assembly of metagenomes

The majority of our 256 samples will be sequenced only by the short-read platform. It will therefore be worth assembling this data in order to obtain much longer fragments ("contigs"), comparable to the Nanopore long reads, with the caveat that metagenome assemblies are often of a chimeric nature (i.e. they include reads originating from different organisms, albeit near-identical ones).

The metagenomic short reads will thus be assembled using dedicated software such as MEGAHIT (Li et al., 2015) or metaSPAdes (Nurk et al., 2016). This will result in contigs, some of which may be long, and may even approach or represent a complete genome – but this is very unpredictable. If a sample is dominated by a very small number of organisms then conceivably, near-complete genomes might result (Tyson et al., 2004); but we note that in some assembly exercises even with pooled samples averaging hundreds of millions of metagenomic reads, only a few assemblies of > 1 Mb resulted, such as in (Tully et al., 2017), which required further processing required to produce "complete" genomes (in essence, some are hybrids of very closely-related genomes).

Therefore, in the general case, we anticipate long assemblies without being able to recover complete genomes. **These assemblies will be analysed in the same manner as the long nanopore reads** (see above), with the exception that matches cannot be treated as quantitative. (Back-mapping of reads to the assemblies will provide approximate frequency data if necessary.)

Quantitation and normalisation: The aims of the above analyses are principally to provide the incidence and frequency data regarding AMR gene occurrence in the different samples. As in any metagenomics study, frequencies of ARGs determined by sequence-read counts are necessarily proportional. Within-sample comparisons of these metrics are valid, e.g. ARG X is twice as abundant as ARG Y. However, in the general case, between-sample comparisons cannot be made using proportional data (other than where the samples are purely technical replicates); absolute abundances of the same thing (gene or organism) can for example be equal in two samples but differ greatly in proportional terms, due to very large differences in the absolute abundance of a second gene/organism. This particular cause of heteroscedasticity has long been recognized in other fields such as transcriptomics, but direct comparison of proportional abundances is still commonplace in microbiome studies, including in some recent AMR-detection studies (e.g. Munk et al., 2018), although others have employed a normalization (e.g. Noyes et al., 2016).

However, best practice in normalization of count data from microbiome sequencing is not firmly established and is a very active area of research (e.g. Zhang et al., 2017), even for data where the microbiomes being compared are of the same type, e.g. comparing two independently obtained samples of cow faeces; we note that other AMR detection-by-metagenomics studies usually focus on a narrow type of microbiome such as this. Existing methods generally rely on an assumption of equivalence at a medial level or at a particular percentile (e.g. Paulson et al., 2013), which is reasonable for a particular type of microbiome, and we will employ this normalisation. However, we note that between-sample read-count normalization in this study is problematic, because any underlying assumptions are potentially more questionable when comparing what might be fundamentally different microbiomes (e.g. a raw fish microbiome with lettuce leaf). Bearing in mind these caveats, our preferred approach will be to apply the subsequent models (Objective 02-2) to our data using more than one normalization method.

In summary, the above analyses will provide the incidence data required by Objective 02-2, namely:

- proportion of samples that contain AMR genes,
- average number of different AMR genes per sample
- distribution of numbers of different AMR genes per sample across samples
- relative abundance of different AMR genes

In addition, useful data on associated taxonomic incidence will result from the exploitation of the metagenomic reads and of the long-read data in particular.

Computing resources

Storage of raw data and data derived by analysis thereof:

- High-throughput short-read sequencing (HiSeq) will total 2 Tbases (equating to approximately 4 Tb file store FASTQ format uncompressed, a maximum of approx. 1.5 Tb compressed). We project 10-20 Tb will be required to accommodate this read data and all analyses, for which we have sufficient capacity.
- Nanopore output will total approximately 200 Gbases, i.e. 10% of the above. Storage for this and the MiSeq data (below) can also be easily accommodated.

- Additionally, the MiSeq 16S metabarcode (Objective 01-5) sequencing will produce approximately 72 Gbases, i.e. < 5% of the HiSeq data.

Computational capacity:

- The most computationally-demanding task will be assembly of metagenome reads Benchmarks have demonstrated that assembly of 10s of millions of metagenome reads by tools such as MEGAHIT and metaSPAdes takes of the order of hours to > 1 day even when using 8 threads with this amount of RAM (Van der Walt et al., 2017). Current Fera resources are ample for these tasks, including multiple Linux servers; two of these each have 144 dual-threaded cores and 0.5 Tb RAM, while two additional servers have 80 dual-threaded cores and the same amount of RAM.

OBJECTIVE 02-2 EXPOSURE MODELLING OF AMR GENE INTAKE IN DIFFERENT RTE FOOD PRODUCT CATEGORIES

The UK National Diet and Nutrition Survey (NDNS) will be used to estimate total intake of AMR from the RTE food categories measured. NDNS is the most representative up-to-date snapshot of UK dietary habits. It includes stratified sampling of multiple age groups and geographical regions. Each individual has an associated sampling weight as a measure of how representative each sampled diet is. These weights will be used to adjust the calculation. The NDNS will also be used to guide the choice of products collected and the sampling plan in Objective 01-3. The sampling plan is designed to ensure a representative collection of samples for each food category, given the UK market shares.

To measure variation of intakes a Monte Carlo sampling approach will be used to simulate total AMR intake per surveyed individual. Measures of AMR in individual measured RTE food samples will be combined randomly with associated food items consumed. Then a total AMR will be generated per person. Important features of this method are:

- Repeated sampling per individual item to account for the variation in the market place for that food type and for variations in the unobserved selection of exact product per person
- Keeping all food types per individual together within each aggregated AMR total intake retains the correlation structure present in real dietary patterns at the individual level
- From the generated realisations, various summaries of the population distribution of AMR intakes can be derived. Summaries will be derived that are consistent with related work to assess AMR contributions from raw meat, dairy, etc. thus allowing comparisons and quantification of relative contributions to total AMR in the gut microbiome.
- Uncertainty in the total AMR for the average diet or a more extreme diet, e.g. 95th percentile of the population distribution can be quantified using the simulations directly.

The AMR intake will also be partitioned into contributions per food category when presenting statistical summaries.

The precise measure or measures that are of interest for future research will be established at an early stage, to ensure appropriate statistical methods are used. Questions will include how a typical diet is to be interpreted, what level of population variability should be quantified, and whether the long-term average intake is of concern. It is known in (chronic) dietary exposure modelling generally that extrapolating from a short-term survey to infer long-term intakes overestimates the number of individuals with zero intakes and underestimates the intake of the usual intake of the highest consumers. Parametric models have been developed to address these issues (van der Voet and van Klaveren, 2010) and will be considered if necessary.

Where replication of samples is available, these data provide information about another level of variation, but this is useful mainly in determining how many samples to collect to avoid potential bias. For the intake modelling, all replicates will be used in the simulation, as their effect on the mean dietary intake will be averaged out over multiple sampling iterations to produce a more accurate estimate.

Uncertainties that cannot be included in the statistical model, due to missing information or simplifying model assumptions, will be recorded within an uncertainty table as recommended in the

guidance of the European Food Safety Authority (Schendel et al., 2018). This is a key output for decision-makers that should be considered alongside any risk output. As far as possible it should include an overall assessment of whether the estimates are likely to be higher or lower than the true AMR gut microbiome, i.e. how conservative is the assessment.

OBJECTIVE 02-3: PRODUCE AND SUBMIT FINAL REPORT TO FSA

A draft final report, summarising Objectives 01-4 to 01-6, and detailing the methodology and results from Objectives 02-1 and 02-2 will be made available to the FSA for comment one month before the final submission deadline (16/12/2020) for FSA comments. The report will be drafted in accordance with the FSA Communication Team's final report formatting guidance, and will include the following sections:

- Layperson summary (no technical language, a maximum of two pages long)
- Executive summary (a maximum of four pages long)
- Background and aims of study
- Methodology
- Results
- Discussion
- Conclusion (including the benefits of the research)
- Recommendations for further work
- References
- Appendices
  A.

A final report, addressing FSA comments and those made by peer-reviewers, will be submitted by 16/12/2020.

OBJECTIVE 02-4: SUBMISSION OF METAGENOME AND METABARCODING DATA TO ONLINE, PUBLIC REPOSITORY

All sequence read data from metabarcoding and metagenomics will be deposited in the Sequence Read Archive (https://trace.ncbi.nlm.nih.gov/Traces/sra/sra.cgi?). Additionally, metagenome data and metadata annotations will be deposited in the EBI Metagenomics resource (Mitchell et al., 2018). Metadata related to retailer or brand will not be associated with individual sample sequence or analysis data.

OBJECTIVE 02-5: PUBLICATION IN PEER REVIEWED SCIENTIFIC JOURNAL (WITH FSA AGREEMENT)

After the final report has been accepted by the FSA, it is proposed that the work would be published in a reputable scientific journal, summarising the findings of the 16S metabarcoding, metagenomic AMR screening and exposure modelling. Dependent upon results, there may be the potential to publish additional work, on e.g. taxonomic makeup of samples and any whole genome sequences obtained. Further avenues for information dissemination would be included such as presentation of the findings at an appropriate conference/event (including, for example, ACMSF) to ensure that external stakeholders, industry and the wider scientific community are made aware. A summary of the results can also be made available on the Fera website.

REFERENCES

APPRILL, A., MCNALLY, S., PARSONS, R. & WEBER, L. 2015. Minor revision to V4 region SSU rRNA 806R gene primer greatly increases detection of SAR11 bacterioplankton. *Aquatic Microbial Ecology,* 75, 129-137.

ARANGO-ARGOTY, G., GARNER, E., PRUDEN, A., HEATH, L. S., VIKESLAND, P. & ZHANG, L. 2018. DeepARG: a deep learning approach for predicting antibiotic resistance genes from metagenomic data. *Microbiome,* 6, 23.

BRANDT, J., & ALBERTSEN, M. 2018. Investigation of Detection Limits and the Influence of DNA Extraction and Primer Choice on the Observed Microbial Communities in Drinking Water Samples using 16S rRNA Gene Amplicon Sequencing. *Frontiers in microbiology, 9.*

BURBACH, K., SEIFERT, J., PIEPER, D. H., & CAMARINHA-SILVA, A. 2016. Evaluation of DNA extraction kits and phylogenetic diversity of the porcine gastrointestinal tract based on Illumina sequencing of two hypervariable regions. *Microbiologyopen, 5*(1), 70-82.

CAPORASO ET AL. 2018. Available: http://qiime2.org [Accessed].

CAPORASO, J. G., LAUBER, C. L., BERG-LYONS, D., LOZUPONE, C. A., TURNBAUGH, P. J., FIERER, N. & KNIGHT, R. 2011. Global patterns of 16S rRNA diversity at a depth of millions of sequences per sample. *Proceedings of the National Academy of Sciences,* 108, 4516-4522.

CAPORASO, J. G., LAUBER, C. L., WALTERS, W. A., BERG-LYONS, D., HUNTLEY, J., FIERER, N., OWENS, S. M., BETLEY, J., FRASER, L., BAUER, M., GORMLEY, N., GILBERT, J. A., SMITH, G. & KNIGHT, R. 2012. Ultra-high-throughput microbial community analysis on the Illumina HiSeq and MiSeq platforms. *The ISME Journal,* 6, 1621-1624.

COSTELLO, M., FLEHARTY, M., ABREU, J., FARJOUN, Y., FERRIERA, S., HOLMES, L., GRANGER, B., GREEN, L., HOWD, T., MASON, T., VICENTE, G., DASILVA, M., BRODEUR, W., DESMET, T., DODGE, S., LENNON, N. J. & GABRIEL, S. 2018. Characterization and remediation of sample index swaps by non-redundant dual indexing on massively parallel sequencing platforms. *BMC Genomics,* 19, 332.

HALLMAIER-WACKER, L. K., LUEERT, S., ROOS, C., & KNAUF, S. 2018. The impact of storage buffer, DNA extraction method, and polymerase on microbial analysis. *Scientific reports, 8*(1), 6292.

HUDSON, J. A., FREWER, L. J., JONES, G., BRERETON, P. A., WHITTINGHAM, M. J. & STEWART, G. 2017. The agri-food chain and antimicrobial resistance: A review. *Trends in Food Science & Technology,* 69, 131-147.

HYEON, J.-Y., LI, S., MANN, D., ZHANG, S., LI, Z. & DENG, X. 2018. Quasimetagenomics-Based and Real-Time-Sequencing-Aided Detection and Subtyping of Salmonella enterica from Food Samples. *Applied and Environmental Microbiology,* 84, e02340-17.

ILLUMINA 2017. Effects of Index Misassignment on Multiplexing and Downstream Analysis.

ILLUMINA. 2018. *Specifications for the MiSeq System* [Online]. Available: https://emea.illumina.com/systems/sequencing-platforms/miseq/specifications.html [Accessed 07/09/2018].

JIA, B., RAPHENYA, A. R., ALCOCK, B., WAGLECHNER, N., GUO, P., TSANG, K. K., LAGO, B. A., DAVE, B. M., PEREIRA, S., SHARMA, A. N., DOSHI, S., COURTOT, M., LO, R., WILLIAMS, L. E., FRYE, J. G., ELSAYEGH, T., SARDAR, D., WESTMAN, E. L., PAWLOWSKI, A. C., JOHNSON, T. A., BRINKMAN, F. S. L., WRIGHT, G. D. & MCARTHUR, A. G. 2017. CARD 2017: expansion and model-centric curation of the comprehensive antibiotic resistance database. *Nucleic Acids Research,* 45, D566-D573.

KENNEDY, N. A., WALKER, A. W., BERRY, S. H., DUNCAN, S. H., FARQUARSON, F. M., LOUIS, P., & THOMSON, J. M. 2014. The impact of different DNA extraction kits and laboratories upon the assessment of human gut microbiota composition by 16S rRNA gene sequencing. PloS one, 9(2), e88982.

JOHANNESSEN, G. S., BENGTSSON, G. B., HEIER, B. T., BREDHOLT, S., WASTESON, Y. & RØRVIK, L. M. 2005. Potential uptake of Escherichia coli O157: H7 from organic manure into crisphead lettuce. *Applied and Environmental microbiology,* 71, 2221-2225.

LAKIN, S. M., DEAN, C., NOYES, N. R., DETTENWANGER, A., ROSS, A. S., DOSTER, E., ROVIRA, P., ABDO, Z., JONES, K. L., RUIZ, J., BELK, K. E., MORLEY, P. S. & BOUCHER, C. 2017. MEGARes: an antimicrobial resistance database for high throughput sequencing. *Nucleic Acids Research,* 45, D574-D580.

LEPLAE, R., LIMA-MENDEZ, G. & TOUSSAINT, A. 2010. ACLAME: A CLAssification of Mobile genetic Elements, update 2010. *Nucleic Acids Research,* 38, D57-D61.

LEWIS, E., HUDSON, J. A., COOK, N., BARNES, J. D. & HAYNES, E. manuscript in preparation. Comparison of Next-Generation Sequencing Techniques for the Identification of Human Pathogens Associated with Fresh Produce.

LI, D., LIU, C.-M., LUO, R., SADAKANE, K. & LAM, T.-W. 2015. MEGAHIT: an ultra-fast single-node solution for large and complex metagenomics assembly via succinct de Bruijn graph. *Bioinformatics,* 31, 1674-1676.

LI, H. & DURBIN, R. 2009. Fast and accurate short read alignment with Burrows–Wheeler transform. *bioinformatics,* 25, 1754-1760.

LIU, Y.-Y., WANG, Y., WALSH, T. R., YI, L.-X., ZHANG, R., SPENCER, J., DOI, Y., TIAN, G., DONG, B., HUANG, X., YU, L.-F., GU, D., REN, H., CHEN, X., LV, L., HE, D., ZHOU, H., LIANG, Z., LIU, J.-H. & SHEN, J. 2016. Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in China: a microbiological and molecular biological study. *The Lancet Infectious Diseases,* 16, 161-168.

MITCHELL, A. L., SCHEREMETJEW, M., DENISE, H., POTTER, S., TARKOWSKA, A., QURESHI, M., SALAZAR, G. A., PESSEAT, S., BOLAND, M. A., HUNTER, FIONA M I., TEN HOOPEN, P., ALAKO, B., AMID, C., WILKINSON, D. J., CURTIS, T. P., COCHRANE, G. & FINN, R. D. 2018. EBI Metagenomics in 2017: enriching the analysis of microbial communities, from sequence reads to assemblies. *Nucleic Acids Research,* 46, D726-D735.

MUNK, P., KNUDSEN, B. E., LUKJANCENKO, O., DUARTE, A. S. R., VAN GOMPEL, L., LUIKEN, R. E. C., SMIT, L. A. M., SCHMITT, H., GARCIA, A. D., HANSEN, R. B., PETERSEN, T. N., BOSSERS, A., RUPPÉ, E., GRAVELAND, H., VAN ESSEN, A., GONZALEZ-ZORN, B., MOYANO, G., SANDERS, P., CHAUVIN, C., DAVID, J., BATTISTI, A., CAPRIOLI, A., DEWULF, J., BLAHA, T., WADEPOHL, K., BRANDT, M., WASYL, D., SKARZYŃSKA, M., ZAJAC, M., DASKALOV, H., SAATKAMP, H. W., STÄRK, K. D. C., LUND, O., HALD, T., PAMP, S. J., VIGRE, H., HEEDERIK, D., WAGENAAR, J. A., MEVIUS, D., AARESTRUP, F. M. & GROUP, E. 2018. Abundance and diversity of the faecal resistome in slaughter pigs and broilers in nine European countries. *Nature Microbiology,* 3, 898-908.

NOYES, N. R., YANG, X., LINKE, L. M., MAGNUSON, R. J., COOK, S. R., ZAHEER, R., YANG, H., WOERNER, D. R., GEORNARAS, I., MCART, J. A., GOW, S. P., RUIZ, J., JONES, K. L., BOUCHER, C. A., MCALLISTER, T. A., BELK, K. E. & MORLEY, P. S. 2016. Characterization of the resistome in manure, soil and wastewater from dairy and beef production systems. *Scientific Reports,* 6, 24645.

NURK, S., MELESHKO, D., KOROBEYNIKOV, A. & PEVZNER, P. 2016. metaSPAdes: a new versatile de novo metagenomics assembler. *arXiv preprint arXiv:1604.03071.*

O'NEILL, J. 2014. Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations.

OH, M., PRUDEN, A., CHEN, C., HEATH, L. S., XIA, K. & ZHANG, L. 2018. MetaCompare: a computational pipeline for prioritizing environmental resistome risk. *FEMS Microbiology Ecology,* 94, fiy079-fiy079.

PAL, C., BENGTSSON-PALME, J., RENSING, C., KRISTIANSSON, E. & LARSSON, D. J. 2013. BacMet: antibacterial biocide and metal resistance genes database. *Nucleic acids research,* 42, D737-D743.

PARADA, A. E., NEEDHAM, D. M. & FUHRMAN, J. A. 2015. Every base matters: assessing small subunit rRNA primers for marine microbiomes with mock communities, time series and global field samples. *Environmental Microbiology,* 18, 1403-1414.

PAULSON, J. N., STINE, O. C., BRAVO, H. C. & POP, M. 2013. Differential abundance analysis for microbial marker-gene surveys. *Nature Methods,* 10, 1200.

PAYNE, A., HOLMES, N., RAKYAN, V. & LOOSE, M. 2018. Whale watching with BulkVis: A graphical viewer for Oxford Nanopore bulk fast5 files. *BioRxiv*.
SCHENDEL, T., JUNG, C., LINDTNER, O. & GREINER, M. 2018. Guidelines for Uncertainty Analysis: Application of the respective Documents of EFSA and BfR for Exposure Assessments: Framework Partnership Agreement GP/EFSA/AMU/2016/01 (agreement 2). *EFSA Supporting Publications,* 15, 1472E.
SEEMANN, T. 2014. Prokka: rapid prokaryotic genome annotation. *Bioinformatics,* 30, 2068-2069.
SIGUIER, P., PEROCHON, J., LESTRADE, L., MAHILLON, J. & CHANDLER, M. 2006. ISfinder: the reference centre for bacterial insertion sequences. *Nucleic Acids Research,* 34, D32-D36.
SOLOMON, E. B., YARON, S. & MATTHEWS, K. R. 2002. Transmission of Escherichia coli O157: H7 from contaminated manure and irrigation water to lettuce plant tissue and its subsequent internalization. *Applied and environmental microbiology,* 68, 397-400.
TRUONG, D. T., FRANZOSA, E. A., TICKLE, T. L., SCHOLZ, M., WEINGART, G., PASOLLI, E., TETT, A., HUTTENHOWER, C. & SEGATA, N. 2015. MetaPhlAn2 for enhanced metagenomic taxonomic profiling. *Nature Methods,* 12, 902.
TRUONG, D. T., TETT, A., PASOLLI, E., HUTTENHOWER, C. & SEGATA, N. 2017. Microbial strain-level population structure and genetic diversity from metagenomes. *Genome research.*
TULLY, B. J., SACHDEVA, R., GRAHAM, E. D. & HEIDELBERG, J. F. 2017. 290 metagenome-assembled genomes from the Mediterranean Sea: a resource for marine microbiology. *PeerJ,* 5, e3558.
TYSON, G. W., CHAPMAN, J., HUGENHOLTZ, P., ALLEN, E. E., RAM, R. J., RICHARDSON, P. M., SOLOVYEV, V. V., RUBIN, E. M., ROKHSAR, D. S. & BANFIELD, J. F. 2004. Community structure and metabolism through reconstruction of microbial genomes from the environment. *Nature,* 428, 37.
VAN BUNNIK, B. A. D. & WOOLHOUSE, M. E. J. 2017. Modelling the impact of curtailing antibiotic usage in food animals on antibiotic resistance in humans. *R Soc Open Sci,* 4, 161067.
VAN DER VOET, H. & VAN KLAVEREN, J. D. 2010. Statistical modelling of usual intake. *EFSA Supporting Publications,* 7, 86E.
VAN DER WALT, A. J., VAN GOETHEM, M. W., RAMOND, J.-B., MAKHALANYANE, T. P., REVA, O. & COWAN, D. A. 2017. Assembling metagenomes, one community at a time. *BMC genomics,* 18, 521.
WALTERS, W. A., HYDE, E. R., BERG-LYONS, D., ACKERMANN, G., HUMPHREY, G., PARADA, A. E., GILBERT, J. A., JANSSON, J. K., CAPORASO, J. G., FUHRMAN, J. A., APPRILL, A. & KNIGHT, R. 2016. Improved Bacterial 16S rRNA Gene (V4 and V4-5) and Fungal Internal Transcribed Spacer Marker Gene Primers for Microbial Community Surveys. *MSystems,* 1, e00009-15.
ZHANG, G., MA, L., BEUCHAT, L. R., ERICKSON, M. C., PHELAN, V. H. & DOYLE, M. P. 2009. Lack of internalization of Escherichia coli O157: H7 in lettuce (Lactuca sativa L.) after leaf surface and soil inoculation. *Journal of food protection,* 72, 2028-2037.
ZHANG, X., MALLICK, H., TANG, Z., ZHANG, L., CUI, X., BENSON, A. K. & YI, N. 2017. Negative binomial mixed models for analyzing microbiome count data. *BMC bioinformatics,* 18, 4.

B. INNOVATION

B. Please provide details of any aspect of the proposed work which are considered innovative in design and/or application? E.g. Introduction of new or significant improved products, services, methods, processes, markets and forms of organization

The use of high throughput, long-read sequencing on the ONT PromethION platform will provide an increased ability to detect AMR genes, and to identify the taxa or mobile elements (e.g. plasmids) in which they are found.

DNA extracts from all samples will be retained for an agreed period of time. Dependent upon how many samples pass the thresholds identified in the metabarcoding work (objective 01-5), this could give up to 744 samples for sequencing and analysis in subsequent projects, at reduced cost (as no additional sampling would be required). This would provide increased information on the distribution of AMR genes in RTE foods, beyond the scope of this project.

The HallMark Sampling System (HMSS) is a custom-built platform (an Innovative IT tool) for managing sampling projects that enables management of the entire sampling process, connecting with multiple Laboratories and FSA. The system is based on tried and tested operational experience

3: THE PROJECT PLAN AND DELIVERABLES

C. THE PLAN

Please provide a detailed project plan including, the tasks and sub-tasks required to realise the objectives (detailed in Part 1). The tasks should be numbered in the same way as the objectives and should be clearly linked to each of the objectives. Please also attach a flow chart illustrating the proposed plan.

Objective	Tasks/Activities/Deliverables
01-1: Project initiation meeting	Task 1: Hold face-to-face meeting with the FSA and Fera in w/c 4th February 2019 as outlined above in the approach.

	Deliverable 1: Submit minutes of project initiation meeting to the FSA.
01-2: Short literature review on AMR in selected ready-to-eat (RTE) foods	Task 1: Decide upon the scope of the literature review. Task 2: Assemble literature on AMR prevalence in appropriate ready to eat foods. Task 3: Extract quantitative information on AMR gene/bacteria prevalence from literature. **Deliverable 2: Submit the finalised scope of the literature review and a summary of objective 01-2, tasks 2 (literature assembled to date) and 3 (AMR gene incidence data in RTE foods) to the FSA.**
01-3: Defined sampling strategy	Task 1: Use NDNS data and data from objective 01-2 to finalise the samples to be taken from specific RTE food types. Task 2: Use retailer data to identify specific samples to be acquired. **Deliverable 3: Submit finalised sampling strategy to the FSA.**
01-4: Collection of 1000 samples of RTE foods	Task 1: Sample RTE products according to the sampling strategy, and courier to Fera. **Deliverable 4: Submit a summary of the 1000 RTE food samples collected to the FSA.**
01-5: 16S Metabarcoding of 1000 RTE food samples	Task 1: Extract DNA from product rinsates, as products arrive. Store DNA at -30°C. Task 2: Perform 16S metabarcoding sequencing and analysis on DNA extracts from 1000 samples. **Deliverable 5: Provide a summary of the sequence and taxonomic data on bacteria present in 1000 RTE food samples to the FSA.**
01-6: Shotgun metagenomic sequencing of a 256 subset of RTE food samples	Task 1: Using data from objective 01-5 identify samples which could go forward for metagenomic sequencing and then using stratification from the sampling plan (objective 01-3), select 256 samples for metagenomic sequencing. Task 2: Sequence 256 samples on Illumina HiSeq 3000. Task 3: Sequence 24 samples (of the 256) on Oxford Nanopore Technologies PromethION. **Deliverable 6: Provide a summary of the metagenomic sequence data from a 256 subset of RTE food samples to the FSA.**
01-7: Produce and submit Year 1 progress report to FSA	Task 1: Summarise results from objectives 01-4 to 01-6. **Deliverable 7: Submit the first-year progress report to FSA.**
02-1: Identification of AMR genes in shotgun metagenome data	Task 1: Analysis of unassembled short reads (Illumina). Task 2: Analysis of long reads (Nanopore). Task 3: Assembly of metagenomes.

	Deliverable 8: Provision of a summary of AMR gene incidence data to FSA.
02-2: Exposure modelling of AMR determinant intake in different RTE food product categories	Task 1: Use data from NDNS and objective 02-1 to estimate dietary exposure to AMR genes. **Deliverable 9: Provide a summary of the risk and uncertainty estimates of dietary exposure to AMR genes to the FSA.**
02-3: Produce and submit final report to FSA	Task 1: Summarise results from objectives 01-4 to 01-6, 02-1 and 02-2. **Deliverable 10A: Submit draft final report to the FSA.** **Deliverable 10B: Submit revised final report to FSA (incorporating the FSA and peer-reviewers' comments and feedback).**
02-4: Submission of metagenome and metabarcoding data to online, public repository	Task 1: Submission of sequence read data to the Sequence Read Archive. Task 2: Submission of metagenome data and annotations to the EBI Metagenomics resource. **Deliverable 11: Make the sequencing data publicly available and provide details to the FSA.**
02-5: Publication in peer-reviewed scientific journal (with FSA approval)	Task 1: Write up results into one or more scientific papers and submit to peer-reviewed journal (with FSA approval). **Deliverable 12: Submission of paper to peer reviewed journal.**

D. DELIVERABLES

Please outline the proposed project milestones and deliverables. Please provide a timetable of key dates or significant events for the project (for example fieldwork dates, dates for provision of research materials, draft and final reporting). Deliverables must be linked to the objectives.

DELIVERABLE NUMBER IN ORDER OF	TARGET DATE	TITLE OF DELIVERABLE
D1	18/02/2019	Submit minutes of project initiation meeting to the FSA.
D2	20/05/2019	Submit the finalised scope of the literature review and a summary of Objective 01-2, tasks 2 (literature assembled to date) and 3 (AMR gene incidence data in RTE foods) to the FSA.
D3	20/05/2019	Submit finalised sampling strategy to the FSA.
D4	21/10/2019	Submit summary of the 1000 RTE food samples collected to the FSA.
D5	23/12/2019	Provide a summary of the sequence and taxonomic data on bacteria present in 1000 RTE food samples.
D6	05/04/2020	Provide a summary of the metagenomic sequence data from a 256 subset of RTE food samples to the FSA.
D7	03/02/2020	Submit the first-year progress report to the FSA
D8	14/06/2020	Provisions of a summary of AMR gene incidence data to the FSA
D9	31/10/2020	Provide a summary of the risk and uncertainty estimates of dietary exposure to AMR genes to the FSA.
D10A	16/12/2020	Submit draft final report to FSA.
D10B	03/02/2021	Submit revised final report to the FSA (incorporating FSA and peer-reviewers' comments and feedback).
D11	03/02/2021	Make the sequencing data publicly available and provide details to the FSA.
D12	03/02/2021	Submission of paper to peer reviewed journal

4: ORGANISATIONAL EXPERIENCE, EXPERTISE and STAFF EFFORT

A. PARTICIPATING ORGANISATIONS' PAST PERFORMANCE

Please provide evidence of up to three similar projects that the project lead applicant and/or members of the project team are currently undertaking or have recently completed. Please include:

- The start date (and if applicable) the end date of the project/(s)
- Name of the client who commissioned the project?
- Details of any collaborative partners and their contribution
- The value
- A brief description of the work carried out.
- How the example(s) demonstrate the relevant skills and/or expertise.
- What skills the team used to ensure the project (s) were successfully delivered.

Project title & value	Start date & end date	Client	Collaborative partners	Description of work	Relevant skills/expertise to ensure success
Development of Metagenomic Methods for Determination of Origin – Phase 2 Value: [redacted]	March 2015 to Present	DEFRA/FSA	Fera were project leads and delivery coordinators; shellfish sample acquisition was subcontracted to CEFAS	Use of a metabarcoding approach to identify bacterial communities in >500 oyster samples, and bacterial and fungal communities in >100 Stilton Cheese samples, and determine whether characteristic microbial communities are indicative of geographical origin	High throughput sequencing of multiple samples from different food categories Sequence analysis of microbial communities, followed by statistical modelling
Future Proofing Plant Health Value: [redacted]	April 2014 to present	DEFRA	Project involves multiple partners (JNCC, NE, Fera, Kew, Forest Research Agenct). In the relevant workpackage (WP4 detection) Fera are the sole contributor	Project to deliver strategic and applied evidence to Defra in a flexible and interdisciplinary framework, to improve biosecurity. Fera leads four out of six work packages, including one dedicated to pest and pathogen detection. Project has delivered evidence on the efficacy of a range of potential detection technologies, including DNA-based molecular detection	Use of multiple HTS approaches (metabarcoding, metagenomics, metatranscriptomics) for targeted and untargeted detection and identification of a number of plant pathogenic microbes
FSA Survey FS 101040: Assessing the contribution made by the food chain to the burden of UK-acquired	January 2014 to September 2017 (currently awaiting acceptanc	FSA	Fera were a subcontractor to University of Liverpool in addition to; Cefas, PHE (who were sub-	Workpackage 4: Prevalence of Norovirus in fresh produce sold at retail. • 1149 leafy green and berry fruit	High throughput of samples in a 1-year survey with strict sample acceptability criteria applied. Sample receipt, photographs and

norovirus infection Value: [redacted]	e of final report)		contracted by Fera for *E. coli* enumeration) Leatherhead research Ltd, University of East Anglia, Royal Liverpool and Broadgreen University Hopsitals NHS Trust	samples analysed for Norovirus GI and GII • Sample receipt and analysis by RT-PCR	record sheets completed. Successful molecular analysis including internal positive controls, blank controls and pre-sampling validation to ensure recovery efficiency. Fera also contributed to the untargeted sequencing work strand, undertaking metatranscriptomic sequencing and analysis of RNA extracts from fresh produce
FSA Survey B18R0006 – A UK-wide microbiological survey of Campylobacter and Salmonella contamination in raw chicken at retail sale in Value: £[redacted]	May 2007 to June 2008	FSA	Fera delivered the sample collection and analysis elements. PHE were a sub-contractor to Fera for speciation of presumptive *Salmonella* spp and *Campylobacter* spp isolates	• 2849 samples analysed for the presence of *Salmonella* spp and *Campylobacter* spp • *Campylobacter* enumeration implemented part-way through the survey in agreement with FSA to provide quantitative data • UKAS 17025 accreditation for all methods	High volume of samples and whole carcass rinse method adopted for sampling. Successful participation in EQA and internal quality control processes during survey. Flexible, competent team ensured delivery maintained and milestones met. Sample receipt, photographs and record sheets completed. Regular communication with FSA to update on progress in addition to monthly data reporting. Portal access granted to FSA for live data review.
National Residue Monitoring Programmes 2017 Value: [redacted]	01/01/2017 to 31/12/2017	Veterinary Medicines Directorate, Mattilsynet (Norwegian Food Safety Authority)	None	• 40,000 samples analysed for the presence of trace residues of veterinary medicines as required by Council Directive 96/23/EC; • 35 analytes groups analysed by LC-MS/MS;	High volume of samples (approx. 800 per week) received, processed, analysed and reported. Wherever possible, processes were automated using a laboratory management system (LIMs). Flexible use of staff and equipment to meet turnaround times. All processes fully recorded and an

				• ISO 17025 accreditation for all methods • Turnaround times monitored monthly against customer KPIs.	audit trail available for each sample. Monthly reports sent to customers.

Evidence of HallMark Sampling Expertise;

	FS102109 EU Harmonised Survey of Antimicrobial Resistance (AMR) on Retail Meats – Retail sample collection, transportation and Survey design services (Year 1/year 2/Year 3/Year4/year 5 and year 6).
Date/s commenced/ completed	- Year 1 (2015)-Pork Beef Sampling - Year 2 (2016) Chicken - Year 3 (2017) Pork and beef sampling - Year 4 (2018) Chicken - This full EC study is planned to run until December 2020 with yearly alternating sampling of poultry and beef/pork
Name of the client who commissioned the project	FSA Project Officer details: Kirsten Stone Microbiological Risk Assessment Branch Science, Evidence and Research Division Food Standards Agency, Floor 1 Aviation House; 125 Kingsway; WC2B 6NH Tel: 0207 276 8993 Email: Kirsten.Stone@foodstandards.gsi.gov.uk
Details of any collaborative partners and their contribution	- RVC work with HallMark as consultants. RVC provide expert advice with regard to sampling strategies and sample size estimation - The laboratory performing the analyses is APHA Weybridge
Value	[redacted]
Brief description of the work carried out	In accordance with Directive 2003/99/EC on monitoring of zoonoses and zoonotic agents Member States must ensure that monitoring provides comparable data on the occurrence of AMR in zoonotic agents and, in so far as they present a threat to public health, other agents. In particular, Member States must ensure that the monitoring provides relevant information at least with regard to a representative number of isolates of Salmonella spp., Campylobacter jejuni and Campylobacter coli from cattle, pigs and poultry and food of animal origin derived from these populations. As part of the requirement FSA have to provide data that can be compared with that of other member states. The Survey has been designed and implemented by HallMark in accordance with the OJEU Decisions (2013/652/EU) and EFSA Technical Specification (2014; 12(5):3686). This full EC study is planned to run until December 2020 with yearly alternating sampling of poultry and beef/pork. The 2015 investigation requires sampling of retail meats – 300 pork and 300 beef – randomly collected with proportional allocation to market-share for outlet type, population (NUTS-3) coverage and an even sampling distribution throughout the year. This is a microbiological Survey where the samples collected are fresh meat (i.e. chilled, not frozen) as sliced or diced cuts; including vacuum-wrapped or wrapped in a controlled atmosphere. As this is a microbiological study the samples are transported in a particular way such that the microbiological integrity of the samples remains intact. Arrival at the laboratory (APHA Weybridge) is within 24h of collection, under consideration of laboratory handover and timeline requirements. Sample collection is scheduled to be completed by the

	end of December 2015. During delivery HallMark has implemented review points with the Surveyors and with the FSA to achieve consistency throughout the project and ensure the collection of data is completed and quality checks carried out.
How the example provided demonstrate the relevant skills and/or expertise	- Ability to design statistically sound, practical and cost-effective sampling plans optimized for the achievement of pre-defined technical objectives such as those defined in this proposal - Ability to obtain samples for microbiological analyses so the microbiological integrity of the samples remains intact - Avoidance of cross contamination of samples - Temperature control - Ability to transfer samples to testing Laboratories within 24 hours. - Capacity to obtain large numbers of samples across the UK - Ability to accurately log sample details - Ability to transfer data efficiently and securely - Processes to store samples prior to packaging and transport to a laboratory - Ability to work closely with Laboratories
What skills the team used to ensure the project (s) were successfully delivered	- Project design - demonstrating the ability to create effective, efficient, VFM solutions - Contract and project management - illustrating a knowledge of management systems and approaches, IT, organisational and administrative skills. Communication skills - via quality reporting, interpersonal skills, relationship management for contract providers and stakeholder's presentation skills where appropriate - People management - recruitment, training and deployment of the correct volumes of staff to meet project requirements and the handling of dispersed teams - Application of quality management and assurance practices including the development of instructions and logistics, knowledge of continuous improvement, quality assurance of the integrity of IT systems and project equipment - Management of sampling, Surveys and studies - Innovation – proven ability to generate and implement new ideas and practice within project processes - Flexibility – adaptability in the face of altering circumstances and changing objectives

FS101196 Surveillance Study of Antimicrobial Resistance (AMR) in Campylobacter on Chicken and AMR in Salmonella on Pork sampled at retail. Lot 1 Study design, sample collection at retail and transportation to the testing laboratory	
Date/s commenced/ completed	From 1/06/17 to 29/09/17
Name of the client who commissioned the project	FSA Project Officer details: Bhavna Parmar, Science Evidence and Research Division Food Standards Agency, London UK Bhavna.Parmar@foodstandards.gsi.gov.uk
Details of any collaborative partners and their contribution	-RVC work with HallMark as consultants. RVC provide expert advice with regard to sampling strategies and sample size estimation - -The laboratories performing the analyses were APHA Weybridge, PHE Porton, PHE London and AFBI (Ireland)
Value	£[redacted]

Brief description of the work carried out	The Food Standards Agency was undertaking a baseline survey within the UK to determine the prevalence of antimicrobial resistant micro-organisms in Campylobacter on fresh and frozen chickens and AMR in Salmonella species (spp.) on fresh pork mince. Data on AMR in retail chicken and pork was required to inform AMR risk assessment in the food chain and to monitor trends in emerging AMR issues. The information will help to track progress with interventions aimed at tackling AMR and to contribute to the wider international effort on AMR surveillance.
How the example provided demonstrate the relevant skills and/or expertise	As previous example
What skills the team used to ensure the project (s) were successfully delivered	As previous example

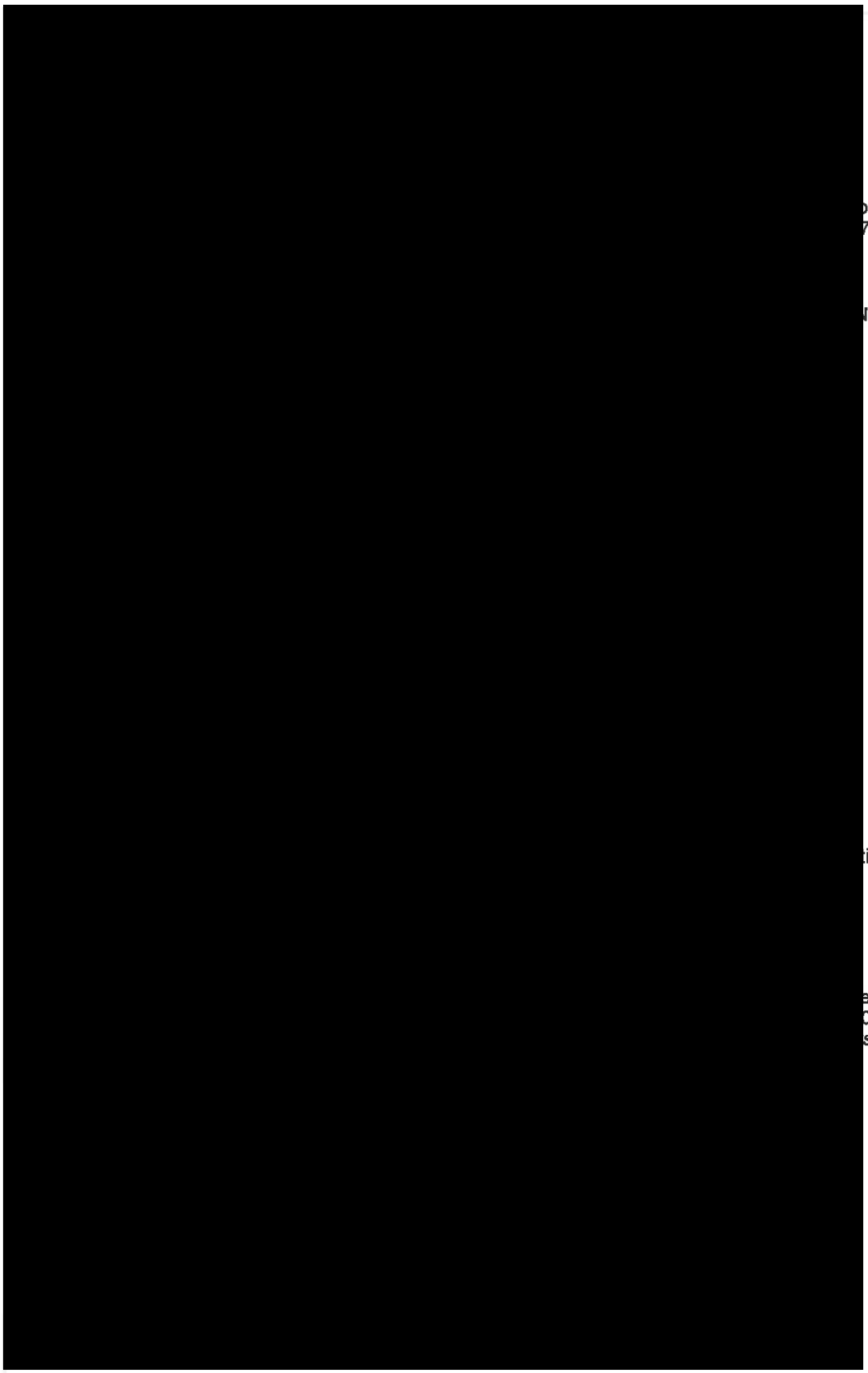
B. NAMED STAFF MEMBERS AND DETAILS OF THEIR SPECIALISM AND EXPERTISE

For each participating organisation on the project team please list:- the names and grades of all staff who will work on the project together with details of their specialism and expertise, their role in the project and details of up to 4 of their most recent, relevant published peer reviewed papers (where applicable). If new staff will be hired to deliver the project, please detail their grade, area/(s) of specialism and their role in the project team.

Lead Applicant	Fera Science Ltd

Named staff members, details of specialism and expertise.

[redacted]



[redacted]

C. STAFF EFFORT

In the table below, please detail the staff time to be spent on the project (for every person named in section above) and their role in delivering the proposal. If new staff will be hired in order to deliver the project please include their grade, name and the staff effort required.

Name and Role of Person where known/ Role of person to be recruited	Working hours per staff member on this project
Edward Haynes	[redacted]
Ian Adams	
Christine Conyers	
Hollie Pufal	
John Walshaw	
Sam McGreig	
Marc Kennedy	
Roy MacArthur	
Total staff effort	

5: PROJECT MANAGEMENT

Please fully describe how the project will be managed to ensure that objectives and deliverables will be achieved on time and on budget. Please describe how different organisations/staff will interact to deliver the desired outcomes.
Highlight any in-house or external accreditation for the project management system and how this relates to this project.

Project management is recognised as an important aspect of Fera's work. Fera has designated this a key competence and provides ongoing training and development of project management skills for its staff. The Project Management System applied across Fera is based on Prince 2™ methodology and complies with ISO 9001 standards. This supports best practice and continuous improvement thus enabling delivery of a high quality and cost-effective service to our customer. Fera uses proprietary software (Retain International) to draw up resourcing plans for delivery staff, and progress against them is measured using the timesheet system. Individuals and teams are managed by dedicated Active Managers.

This project will be closely managed by Edward Haynes who will be the project manager (PM) and will have overall responsibility for the delivery of the project to specification, to time and to the required quality standard. In support of the PM, Fera has a Project Management Team who monitor and support the smooth running of all projects to ensure milestones and budgets are met and invoices are issued on time. Edward Haynes will liaise closely with the FSA Project Officer either via face-to-face meetings or by telephone and email. Two face-to-face meetings in London are proposed and additional teleconferences can be arranged as and when necessary. The PM will ensure the FSA Project Officer is kept aware of progress with the project. If any areas of concern arise, he will act quickly to take appropriate remedial action involving the FSA Project officer in any decisions where appropriate. Fera also has the in-house support of dedicated specialists in Information Management, Intellectual Property, Law, Copyright and Health and Safety. Edward Haynes will assess and address any issues that may arise concerning these matters and has three years of successful project management experience at Fera which have provided him with the relevant skills to ensure this.

Activities contributing to individual milestones (e.g. Sequencing, Bioinformatics, Statistical analysis) will be planned and overseen by relevant experts at Fera Science Ltd, in close conjunction with the PM.

The work of HallMark Veterinary & Compliance Services will be coordinated by a dedicated project manager at HallMark. This project manager will coordinate with the overall Fera project manager (Edward Haynes) through regular phone and email contact, during the design phase for sample collection. Fera will provide another dedicated contact for HallMark to arrange the day-to-day collection and processing of samples at Fera within agreed timescales.

6. RISK MANAGEMENT

In the table provided, please identify all relevant risks in delivering this project on time and to budget. Briefly outline what steps will be taken to minimise these risks and how they will be managed by the project team. Please add more lines as required

Identified risk	Likelihood of risk (high, medium, low)	Impact of Risk (high, medium, low)	Risk management strategy
Lack of sample numbers	Medium	High	The likelihood of delays in samples arriving or high numbers of rejected samples can be mitigated through close communication with samplers and understanding and agreeing the timetable for sampling ahead of starting. Dedicated staff to monitor and implement sampling schedule in agreement with sampling plan. Trained security staff are available for sample receipt and appropriate secure storage 24 hours per day, seven days per week in case of out of hours sample arrival. Close (day to day) project management by Edward Haynes
Cross contamination	Low	High	HTS library preparation will be undertaken under strict 'forensic style' conditions (Annex 1). Competent and skilled staff with good molecular techniques, use of appropriate control samples, and sterilisation of tools and equipment used for sample processing.
Instrument/equipment failure	Low	High	The illumina MiSeq and ONT PromethION are housed within Fera's Molecular Technology Unit and are covered by service contracts provided 24h access to advice and rapid responses from engineers in the rare case of instrumentation failure. In the event that the MiSeq became non-operational and could not be fixed or replaced to a reasonable timescale, metabarcoding libraries could be sequenced at the same service provider as the HiSeq libraries will be sequenced at. If the chosen HiSeq provider experiences instrument failure, multiple other providers are available for sequencing HiSeq libraries. The ONT PromethION is still in Beta testing, so it is possible that it will not perform to expected parameters. Under these circumstances an alternative PromethION could be sought out to sequence the selected samples (e.g. at the University of York). If an alternative PromethION is not available, then samples could be sequenced on ONT MinIONs at Fera, though this would provide a smaller volume of data than the PromethION.
Lack of available staff	Low	High	Fera has identified key scientists who will deliver this project and they have been consulted and confirmed that they will have the time available to deliver this work.

			Fera's staff resource management system (Retain) has been checked to ensure that they are available during the project life. However, should these staff become unexpectedly unavailable (e.g. through illness), this tool would be used for mitigation to identify alternative experienced scientists and colleagues who would be able to deliver this project. A number of scientists with appropriate expertise have been identified in this proposal.
Loss of HiSeq libraries in transit	Low	Medium	Libraries for sequencing on the HiSeq must be couriered from Fera to the chosen provider. Libraries will be couriered with a known courier company with an established track record. Aliquots of library sufficient to re-run will be retained at Fera until data of acceptable quantity and quality is returned. DNA extracts will be retained until the end of the project, and potentially beyond.
Loss of data through IT failure	Low	Medium	All data are automatically backed up daily onto Fera servers; key documents are stored in a central secure project folder.
Breach of data protection	Low	Low	Fera uses a secure data transfer portal which has been used for numerous other commercially sensitive projects. This is maintained by our on-site IT team. Fera is fully compliant with the new GDPR regulations having recently completed a four-month project.
Insufficient time and budget to meet project milestones	Low	Medium	Fera will have a dedicated project manager (Edward Haynes) to co-ordinate the delivery of this project. There are many internal processes in place to monitor the progress of the project, and ensure sufficient resource is available for delivery. These include the use of Retain software, for planning staff utilisation (see previously identified risk, "Lack of available staff"); internal project monitoring spreadsheets for assessing project budget; the completion of biweekly project highlight reports; and attendance and reporting at biweekly project review meetings with the Heads of Programme, Team Manager and Finance Analyst. The project manager will be responsible for keeping the nominated FSA liaison updated with the progress of the project, and appraised of any unforeseen circumstances. From time to time, High Throughput Sequencing reagents experience price changes. If this happens, users are generally informed via email in good time, and we will be able to secure sufficient reagents for the project ahead of any unmanageable increases. We have also built in sufficient contingency time to the project to cope with unforeseen events.

Data quality	Low	Medium	As is the case with all our metabarcoding and metagenomic applications, we will include appropriate controls to assess functioning of the sequencing platform, any to detect any contamination during preparation. These include; Positive control – a synthetic oligonucleotide with known sequence is processed as a sample, from sequence library preparation onwards. Sequence from the control is compared to the reference sequence, to monitor for appropriate functioning of the sequencing platform. Extraction blank – a water sample is processed from extraction phase onwards, to monitor for contamination during extraction. Library preparation blank – a water sample is processed through library preparation (including 16S PCR for the metabarcoding work), to monitor for contamination during library preparation. Index blank – a water sample is processed through the index PCR stage, to monitor for contamination during library preparation. Machine blanks – the sequencer is instructed to look for combinations of indexes (oligonucleotide tags which allow sequences to be attributed to samples) not used in that experiment. This is to monitor levels of index hopping, which are already mitigated against during metagenomic sequencing by the use of Unique Dual Indexes (see OBJECTIVE 01-6 SHOTGUN METAGENOMIC SEQUENCING OF 256 SAMPLES). We have standard procedures for assessing the acceptability of controls, and these will be followed in this project. Sequence quality will also be considered; • DNA sequence data quality assurance will be as specified in our standard procedures. For 16S metabarcoding, this includes detection and removal of primer sequences; joining of paired-end reads; read-trimming according to per-base quality scores; discarding of short reads and those with high ambiguity-code counts; denoising; and detection/discarding of chimeric sequences. The latter steps are especially important to reduce misidentification, which would potentially compromise even the distinguishing of host organellar DNA versus bacterial DNA, (which is the principal aim in our case). • Shotgun metagenomic sequence data will be quality controlled according to quality scores, ambiguities and read lengths. In both cases, resulting numbers of high-quality reads will indicate if any samples are unusable and need to be repeated.

			There is consideration for contingency and resampling (see above). The PromethION sequence reads are expected to contain relatively high error frequencies compared to the Illumina platform. These will therefore be regarded in conjunction with mapped short reads as described in "Objective 02-1: Analysis of long reads, (iv)". Nanopore results (identified ARGs) which are neither near-identical to known ARG sequences nor supported by Illumina reads, will be treated as putative only.
Sampling equipment required for sample collection is not effectively sourced and dispatched to Surveyors on time.	Low	Medium	• Before sampling starts, HallMark operations will provide the relevant Surveyors with the required equipment. • If the sampling equipment required for sample collection is not effectively sourced, an option to avoid delay would be to purchase locally, if available. • HallMark aims to have several approved suppliers of equipment as backup. Spare kits are maintained in a central office ready to be sent to Surveyors if required
Sample incorrect - incorrectly selected, insufficient material, incorrectly packed or with necessary information missing leading to unassayable sample	Medium	High	• Before sampling starts, HallMark will provide Surveyors with clear instructions to minimise any issues. • Training to be carried out and verified before attempting sampling. • The Project manager to produce aide-memoire to be given to all Surveyors with the packaging material • Laboratory Submission Letter (Log sheet) will be provided for the Surveyor to record details of the collections of the sample and to ensure traceability. • Digital photograph of sampled product will be quality checked to ensure they are of sufficient clarity to allow all on pack information to be read and all recorded information to be checked. There is consideration for contingency and resampling (see above).
Sample arrives unsuitable for testing - e.g. samples not maintained under the appropriate conditions once collected, resulting in numbers of samples rejected due to high temperatures.	Medium	High	• The Surveyors will be given clear instructions on the handling, packaging and preservation of samples prior to their transportation to the laboratory to ensure the avoidance of cross or other contamination, damage during transport, deterioration of samples of products, loss of unstable contaminants or growth, and/or changes to the micro-organisms present in the sample due to temperature changes. • On purchase, samples will be kept at their appropriate temperature to prevent

			deterioration and according to the legislative requirement. To transport chilled samples, each day's collection will be sealed into appropriately temperature-controlled boxes. • It is essential that sufficient ice packs and packing are included in the cool box to ensure that chilled foods stay below 8°C. For example, in periods of hot weather extra cool packs are added etc. • During the warmer parts of the year high performance thermal protection is used when shipping microbiological samples. This is pre-qualified to maintain a payload temperature of 2-8C for 36h. • Perishable samples delivered to laboratory with a target of a maximum of 24 hours from sampling. • The sample temperature will be measured at arrival to determine that the samples are at the correct temperature. • If unsuitable for testing, the sample will be discarded and a resample will be requested There is consideration for contingency and resampling (see above).
Sample(s) arrive/s with no, or obscure, identification	Medium	Low	• Log sheets will be provided for the Surveyor to record details of the collections of the samples and to ensure traceability. • Digital photograph of sampled product to be taken and should be of sufficient clarity to allow all on-pack information to be read and all recorded information to be checked. • The Surveyor will be contacted, and we will clarify the situation for rectification. If this is not possible, the sample(s) would have to be discarded and resamples taken.
Lack of direct AMR expertise in the project team	Low	Low	The team does have some experience of AMR research. John Walshaw, as editor of the journal Microbiome, has reviewed numerous papers on AMR. Edward Haynes is currently supervising a PhD student who is analysing the genomics of AMR in Listeria monocytogenes, and who will be screening produce metagenomes for AMR determinants in the next year. The team also has extensive expertise in the most critical areas of the project, namely high throughput sequencing, the analysis and interrogation of metagenome data for identification of taxa and genes of interest, and exposure modelling. With regards to acquiring AMR expertise, Fera has several options for consulting AMR experts. Fera operates a joint research institute with Newcastle University, the Institute for Agrifood Research and Innovation,

			which exists to facilitate collaboration between the two organisations. Considerable AMR expertise resides at Newcastle University, which may be accessed if necessary. Beyond Newcastle University, we have a number of collaborators and contacts with AMR expertise (through the University of Leeds, the Centre for Innovation Excellence in Livestock, the US Food and Drug Administration, etc.) who can be consulted, either formally or informally. Furthermore, AMR is highlighted in the Fera Science strategy (available at www.fera.co.uk) as an important area for the future of the organisation, where we commit ourselves to, "integrate our capabilities in microbiology & genomics to deliver better control measures & address emerging challenges including antimicrobial resistance." Given the emphasis placed on AMR in our science strategy, it is likely Fera will seek to acquire in house AMR expertise in the future.

7. QUALITY MANAGEMENT

A. QUALITY MANAGEMENT

Please provide details of the measures that will be taken to manage and assure the quality of work. You should upload your Quality Assurance policy in the supporting documents section of your application.

This should include information on the quality assurance (QA) systems, , which have been implemented or are planned, and should be appropriate to the work concerned. All QA systems and procedures should be clear and auditable, and may include compliance with internationally accepted quality standards specified in the ITT e.g. ISO 9001 and ISO17025.

Specific to science projects and where relevant, applicants must indicate whether they would comply with the Joint Code of Practice for Research (JCoPR). If applicants do not already fully comply with the JCoPR please provide a statement to this effect to provide an explanation of how these requirements will be met. The FSA reserves the right to audit projects against the code and other quality standards

The lead principle investigator is responsible for all work carried out in the project; (including work supplied by

This project will be conducted under the ISO 9001 accreditation held by Fera Science Ltd.

DNA extraction and High Throughput Sequencing library preparation will be performed in isolation from other projects and samples, under Fera's forensic standard laboratory conditions to prevent sample cross-contamination (Annex 1).

Fera Science Ltd has a comprehensive and robust system of policies and procedures which underpins its high-quality delivery and international reputation for scientific excellence. These systems are regularly subject to internal and external audits to ensure consistency of service.

Fera has gained Certification by Lloyds Quality Assurance for compliance to ISO 9001: 2008. The scope of activities covered by the certification includes the provision of scientific services in the areas of agriculture, food and the environment to Government and non-Government customers worldwide. Fera has recently been assessed under the new ISO 9001:2015 standard and verbal feedback has indicated that this was successful. Research carried out by Fera is implemented to meet the requirements of the Defra/FSA Joint Code of Practice for Research.

B. ETHICS

Please identify the key ethical issues for this project and how these will be managed. Please respond to any issues raised in the Specification document
Please describe the ethical issues of any involvement of people, human samples, animal research or personal data in this part. In addition, please describe the ethical review and governance arrangements that would apply to the work done.

Applicants are reminded that, where appropriate, the need to obtain clearance for the proposed project from their local ethics committee. This is the responsibility of the project Lead Applicant. However, if a sub-contractor requires such clearance the project Lead Applicant should ensure that all relevant procedures have been followed. If there are no ethical issues please state this

There are no ethical issues associated with this project. We do not propose to collect human or animal samples of any kind, nor do we propose to compare the data generated in this study with human ARG datasets, as these are outside the scope of the project described.

C. DATA PROTECTION

Please identify any specific data protection issues for this project and how these will be managed. Please respond to any specific issues raised in the Specification document.
Please note that the successful Applicant will be expected to comply with the Data Protection Act (DPA) 1998 and ensure that any information collected, processed and transferred on behalf of the FSA, will be held and transferred securely.

In this part please provide details of the practices and systems which are in place for handling data securely including transmission between the field and head office and then to the FSA. Plans for how data will be deposited (i.e. within a community or institutional database/archive) and/or procedures for the destruction of physical and system data should also be included in this part (this is particularly relevant for survey data and personal data collected from clinical research trials). The project Lead Applicant will be responsible for ensuring that they and any sub-contractor who processes or handles information on behalf of the FSA are conducted securely.

Fera is committed to compliance with its obligations arising under all applicable data protection regulations affecting its business (including the Data Protection Act 2018 and the General Data Protection Regulation (EU) 2016/679 ("GDPR")), and in supporting the compliance efforts of our clients where we process personal data on their behalf. For client work where Fera processes personal data, such data is processed only on the documented instructions of the controller.

Fera maintains a series of policies, processes and procedures throughout its organisation that highlight key obligations from the data protection legislation, map them across to our operational areas, establish formal controls to record and demonstrate our compliance. Fera's master Data Protection Policy (and its supporting documents) contain more detailed guidance for staff in ensuring compliance with the requirements of the data protection legislation.

To meet our obligations under Article 30(1) GDPR, Fera's Information Governance Officer (IGO) maintains an Information Asset Register (IAR) which records our data processing activities and datasets under our control. Fera additionally has documented procedures for certain areas where more specific guidance is required, including:

- personal data breach reporting;
- managing Subject Access Requests; and
- conducting Data Protection Impact Assessments.

To ensure compliance, all senior staff (and staff who routinely access personal data), have received specific GDPR training; and all Fera staff have received data protection training. All staff are under contractual obligations of confidentiality which prevent them from disclosing personal data to third parties without permission.

Data will be stored on our secure network (which is PSN (Public Services Network) compliant: https://www.gov.uk/guidance/public-services-network-psn-compliance). Any personal data transferred by Fera will be transmitted via Fera's Secure Data Transfer facility or use of encryption technology. When it is no longer needed, it will be removed from our servers and will be retained in our backup system for a maximum of two years (unless otherwise instructed by the client).

Fera maintains a data sharing policy which ensures that any transfers of personal data are managed in accordance with the requirements of the data protection legislation. When in use, hard-copy personal data is stored securely and only accessed by those who need to access it. If any hard-copy personal data is transferred, it will be done so by use of secure courier, or in person. At the end of the processing activities, hard-copy personal data is destroyed by use of our secure document destruction service or returned to the data controller.

Fera appoints sub-processors only with the prior written authorisation of the controller and manages sub-processors via binding contracts under which they must:

- only process personal data on the written instructions of the controller;
- ensure that people processing the data are subject to a duty of confidence;
- take appropriate measures to ensure the security of processing;
- only engage sub-processors with the prior consent of the controller and under a written contract;
- assist the controller in meeting its GDPR obligations in relation to the security of processing, the notification of personal data breaches and data protection impact assessments;
- delete or return all personal data to the controller as requested at the end of the contract; and
- submit to audits and inspections, provide the controller with whatever information it needs to ensure that they are both meeting their Article 28 obligations, and tell the controller immediately if it is asked to do something infringing the GDPR or other data protection law of the EU or a member state.

In this instance, Fera does not consider that any specific actions are required to achieve data protection compliance since the project data is expected to relate to companies rather than identifiable individuals. In addition, any data which is made available publicly will be anonymised prior to its release. Fera is, however, willing to discuss specific privacy/data protection issues with clients on a case-by-case basis.

Subcontractors will be required to provide appropriate GDPR assurances. Specific information about the HallMark sampling system is provided below;

HallMark Sampling System - Specific security measures
How the Data is accessed

- **Secured Access via SSL**
  - HTTPS (SSL) protocol is used for our systems so that users work over a secure communication link between their devices and the server. The data transferred is encrypted and cannot be read by anyone except the current user of the device
- **Advanced password encryption**
  - User authentication uses the latest techniques for keeping passwords secure, and allows easy review and upgrade of the hashing algorithms used
  - A robust encryption method called Blowfish is used which, along with unique salt, offers an extremely secure method for storing passwords
- **PIN Required**
  - When users sign in, they are also required to key in 2 digits randomly chosen from their 4 digit PIN. They are reminded to change their PIN every 12 weeks
- **Apache htaccess**
  - Apache's htaccess file system is used which allows the setting of another level of security restrictions for accessing a directory or a file
- **Sanitised Queries**
  - All database queries go through a sanitisation process before hand to prevent any SQL injection into the database

How the System is Updated & Maintained

- **Who has access?**
  - The only people that have access to the hosting servers and databases are the server administration staff and trusted employees. Passwords are never shared with anyone outside of the company. i.e. no third-party contractors
- **Non-disclosure agreement**

- All developers are party to a non-disclosure agreement ensuring all customer data and source code will stay confidential
- **Source code built by Evergreen Ltd**
  - All source code used in the system have been built or vetted in our suppliers. Evergreen Ltd do not work with 3rd party contractors or developers to build any systems
  - All their employees are based in the UK
- **File/Folder permissions**
  - All files/folders have relevant permissions set to prevent unauthorised access and changes to the system
- **Secured File Transfers**
  - Any data or file transfers to the server are carried out under the SSL protocol to stop any unwanted sniffing of files. This uses an encryption layer as the files are transferred
- **Additional security**
  - Additional security measures may be suggested for certain scenarios, based upon business requirements and sensitivity of data to be stored
  - As the system is bespoke, we are open to discussion about any further security measures or requirements that are deemed necessary

About the Web Hosting Servers

We have 24/7 remote access and full control of the hosting platform, installation software and security patches. The data centre, which is based in the UK, offers a premium environment for business-critical servers and data with fully secure power supply, cooling, security and network resilience systems including:

- Uninterruptable Power Supplies
- Diesel Generators for back-up power
- Air Conditioning
- VESDA smoke detection and fire suppression

The operating system used is server grade Linux running the latest stable versions of appropriate server software.

A high-availability cluster of 2 web servers running the Apache web server and PHP scripting provides the data interface to the industry standard MySQL database.

One server provides the master database which is replicated in real time to a slave database. The slave can take the role of master in case of failure.

All servers are remotely accessible for ease of system upgrades, maintenance and backups.

System security is achieved through the use of password-controlled database and server access.

Database back-ups are made every hour from the slave database, so that the operation of the master is uninterrupted, and a full & complete snapshot can be taken. The back-ups are rotated every 24 hours and a monthly copy is also saved. A daily snapshot is automatically moved off site as a further precaution.

The system has the following benefits:

- Archive data collected
- Security systems
- Efficient monitoring and reporting system
- Managers can remotely monitor all data
- Risk of data loss is minimised through daily back-up procedures
- Remote access for FSA colleagues can easily be arranged

D. SUSTAINABILITY

The Food Standards Agency is committed to improving sustainability in the management of operations. Procurement looks to its suppliers to help achieve this goal. You will need to demonstrate your approach to sustainability, in particular how you will apply it to this project taking into account economic, environmental and social aspects. This will be considered as part of our selection process and you must upload your organisations sustainability policies into the eligibility criteria in Bravo.

Please state what (if any) environmental certification you hold or briefly describe your current Environmental Management System (EMS)

Fera and our parent company Capita take sustainability seriously and follow a robust environmental policy that includes challenging targets. In the five years prior to establishing Fera Science Limited, The Food and Environment Research Agency reduced water use by 50%, reduced gas

consumption by 30% (equivalent to 1428t CO_2) and electricity use by 28%. A project to replace half of the main chillers in the site saved 172t CO_2 and insulation of the exposed pipework in the greenhouses reduced emissions by 85t CO_2 annually. Fera's previous Sustainable Development Action Plan was one of a very few to be awarded the green star. With the formation of Fera Science Limited, the site was retained by Defra and Fera became one of several tenants and therefore unable to provide representative reporting on current metrics.

As part of Capita Group which is predominantly a service business, Capita's direct environmental impacts are not broad; but the scale of the business means our impacts need t be managed carefully. Almost all Capita employees are office-based meaning that our environmental impacts are those associated with normal modern office facilities.

The Capita focus is on our main Group-wide environmental impacts:

- Minimising energy use at our sites
- Reducing business travel
- Managing our resource use and waste management.

Our environmental management system, based on ISO 14001 standard, allows us to monitor and manage our impacts and continually improve performance in these areas. Our environmental policy sets out our commitment to complying with the relevant environmental legislation and board level responsibilities.

We have reported our carbon footprint since 2005 and in 2015, our carbon emissions were 124,329 tonnes CO_2eq representing a year-on-year decrease of 11% (2014: 139,672 CO_2eq). This decrease was down to a dramatic reduction in business travel emissions of 28% achieved by an 82% reduction in air, a 45% reduction in rail and a 12% reduction in car emissions, partly as a result of our 'smarter working' initiative.

In 2010, we set ourselves a target to reduce the carbon intensity of our offices by 4.5% per year. In 2015, although our carbon emissions for scopes 1 and 2 increased to 88,280 CO_2eq (2014: 84,103 CO_2eq) due to the growth of our international operations, our carbon intensity actually decreased from 15.1 to 19.2.

Also attached with this tender are copies of Fera's Environmental Policy and Manual, and Capita's Environmental Policy and Policy Statement.

The sustainability actions of the subcontractor are described below;

Minimising Travel
HallMark actively monitor company mileage and are looking at ways we can constantly reduce both the time and money staff spend on travelling. We have internal systems in place to check mileage and expense claims monthly. Sampling routes are worked out carefully to minimise travel. All our Surveyors are chosen based on the location (nearest to the selected sampling area) to minimise travelling. Where possible we would combine projects to minimise the travelling.

Meetings

- Public transport (train/bus/metro) is our first choice of travel
- Prior to attending meetings, we establish car share arrangements and encourage travel by public transport
- Consideration is given to the impact of meetings, and we often hold teleconferences instead

Technology

- We have a robust internal communication system that reduces the need to make unnecessary journeys. This includes; email, shareware, telephone and holding webinars
- HallMark uses a Webex facility, which is a specialized product used to present dynamic online events and webinars, deliver online training and eLearning experiences, provides remote technical support, and share knowledge, experience and ideas across. You can have up to 25 people on the meeting
- Training webinars are delivered to surveyors across the UK

- Any company-wide information is posted on the home page of SharePoint, which is immediately available to all employees
- Our innovative IT tool; HMSS manages inspection projects that enable the management of the process and increasing efficiency
- We deliver online training to field staff through our KeySkill platform which includes innovative eLearning experiences. This technology gives us the ability to record training sessions and upload them

Recycling Equipment
It is our policy to recycle equipment whenever possible. The central Support Department coordinates this process to ensure that; 1, equipment is not requested unnecessarily and 2, all equipment is recycled where possible. We control the stock to avoid purchasing more equipment than is actually required for successful contract delivery. In the sampling department, we prevent waste creation by precisely calculating the packing equipment needs of each surveyor before the sampling round. This prevents surplus equipment being sent and possibility of waste. With the exception of disposable equipment, we maximise our efforts to recycle equipment from leavers returning their used items.

Since 2015 HallMark has provided UK-wide retail sample collection, transportation and design services for the FSA via the EU Harmonised Survey of Antimicrobial Resistance (AMR) on Retail Meats project. In 2015, 16 and 17 HallMark established handover protocols with the laboratory for the recycling of chill packs. For 2018, the laboratory has again agreed to work together with HallMark and recycle the chill packs. This reduces equipment costs and improves the project's environmental profile. Where possible, and working together with the laboratories and the FSA, we will increase recycling options for this project. It may be possible to extend our sampling box recycling agreement with the selected laboratories.

E. DISSEMINATION AND EXPLOITATION (Science Projects Only)

Where applicable please indicate how you intend to disseminate the results of this project, including written and verbal communication routes if appropriate. Applicants are advised to think carefully about how their research aligns with the FSA strategy, what is the impact that their research has on public health/ consumers and decide how the results can best be communicated to the relevant and appropriate people and organisations in as cost-effective manner as possible. Please provide as much detail as possible on what will be delivered. Any costs associated with this must be documented in the Financial Template.

The applicant should describe plans for the dissemination of the results for the project team as a whole and for individual participants. Details should include anticipated numbers of publications in refereed journals, articles in trade journals etc., presentations or demonstrations to the scientific community, trade organisations and internal reports or publications. Plans to make any information and/or reports available on the internet with the FSA's permission are also useful, however, this does not remove the requirement for Tenderers to think how best to target the output to relevant groups.
If a final report is part of the requirement, please make sure, as part of the executive summary, that aims and results are clear to the general audience and that the impact of the research on public health/consumers and it's alignment to FSA priorities is clearly stated.

Please note that permission to publish or to present findings from work supported by the FSA must be sought in advance from the relevant FSA Project Officer. The financial support of the FSA must also be acknowledged.

Please indicate whether any Intellectual Property (IP) may be generated by this project and how this could be exploited. Please be aware the FSA retains all rights to the intellectual property generated by any contract and where appropriate may exploit the IP generated for the benefit of public health.
In this part Applicants should demonstrate the credibility of the partnership for exploitation of the results and explain the partnership's policy in respect of securing patents or granting licenses for the technology (if applicable). It should deal with any possible agreements between the partners to extend their co-operation in the exploitation phase and with relevant agreements with companies, in particular users, external to the partnership.

Fera proposes to publish this work in a reputable scientific journal (in agreement with the FSA). There is scope to publish at least one paper, on the findings of the 16S metabarcoding, metagenomic AMR screening and exposure modelling. Dependent upon results, there may be the potential to publish additional work, on e.g. taxonomic makeup of samples and any whole genome sequences obtained. Further avenues for information dissemination would be included such as

presentation of the findings at an appropriate conference/event (including, for example, ACMSF) to ensure that external stakeholders, industry and the wider scientific community are made aware. A summary of the results can also be made available on the Fera website.

Sequence and metagenome analysis data will be made freely available on public data repositories.

Regarding public dissemination, Fera Marketing and Communications team will work closely with the project team and look to publicise the work via our own website, social media and with support from the group PR team, plus where appropriate the FSA communications team using outputs including production of information and articles so that the outcomes of the research can be targeted towards the appropriate stakeholders including the public. The results from this work could be used in industry led publicity campaigns promoting best practice in this area. Fera and the project scientific team are committed to the rapid, extensive and effective communication of results. We will discuss with the project officer as to the best way to disseminate the project outcomes in order to promote the current science and knowledge of the research area.

SCHEDULE 4

PRICING

This Schedule 4 specifies the Ordered Services to be provided to the Client by the Supplier in the services required for FS301050, with reference to their Financial Proposal.

1. INTRODUCTION

1.1 This Schedule 4 sets out the Basis of Charging that shall apply to this Contract and any attendant Purchase Orders.

1.1. Other than as provided in this schedule or agreed in writing in a relevant Purchase Order no additional Charges shall be payable by the Client to the Supplier for any additional costs associated with the execution of the Services or the Deliverables, including, without limitation, administrative and overhead costs.

2. BASIC PRINCIPLES

2.1 In general, all prices charged by the Supplier to the Client for all services (Support and Development) throughout the duration of this agreement shall be calculated from the Charges Schedule:

2.2 In addition the Client will reimburse travel and subsistence expenses which are reasonable and agreed in advance as set out in the table below, **where Tenderers have indicated such expenses will be applicable within their Qualifications to** Schedule 7, Charges:

Expenses	Reimbursement
Rail travel	Standard class
Mileage	£0.45 per mile for the first 10,000 miles in a financial year £0.25 per mile for any mileage in excess of 10,000 miles in a financial year
Overnight hotel accommodation	Up to £85 per night outside London Up to £130 per night in London
Subsistence	Up to a maximum of £21 for a 24 hour period

Tender Reference	FS301050

Tender Title	What is the Burden of Antimicrobial Resistance Genes in Selected Ready-to-Eat Foods?

Full legal organisation name	Fera Science Ltd

Main contact title	Dr
Main contact forname	Edward
Main contact surname	Haynes

Main contact position	Molecular Biologist
Main contact email	edward.haynes@fera.co.uk
Main contact phone	01904 462515

Will you charge the Agency VAT on this proposal?	Yes

Please state your VAT registration number:	GB 618 1841 40

Project Costs Summary Breakdown by Participating Organisations
Please include only the cost to the FSA.

Organisation	VAT Code*	Total (£)
Fera Science Ltd	STD	£348,355.87

Total Project Costs (excluding VAT) **	**£348,355.87**

* Please indicate zero, exempt or standard rate. VAT charges not identified above will not be paid by the FSA

** The total cost figure should be the same as the total cost shown in table 4

** The total cost figure should be the same as the total cost shown below and in the Schedule of payments tab.

Project Costs Summary

Staff Costs	[redacted]
Overhead Costs	
Consumables and Other Costs	
Travel and Subsistence Costs	
Other Costs - Part 1	
Other Costs - Part 2	
Other Costs - Part 3	

Total Project Costs	£348,355.99

Staff Costs Table

*This should reflect details entered in your technical application section 4C.
Please note that FSA is willing to accept pay rates based upon average pay costs. You will need to indicate where these have been used.

* Role or Position within the project	Participating Organisation	Daily Rate (£/Day)	Days to be spent on the project by all staff at this grade	Total Cost (incl. overheads)
Project Manager	FERA	[redacted]		
Sample planning and statistical anaylisis	FERA			
DNA extraction and sequencing	FERA			
DNA extraction and sample management	FERA			
Bionformatic analysis	FERA			
Bionformatic support	FERA			
Sequencing support ...	FERA			
Exposure modelling	FERA			

Total Labour Costs	[redacted]
* Total Overhead Costs (if not shown above)	

Consumable/Equipment Costs

Please provide a breakdown of the consumables/equipment items you expect to consume during the project

Item	Quantity	Cost/Item(£)	Total
Tru Seq Nano DNA High Throughput Library Prep	3	[redacted]	
Tru Sequence Adapter Blocker	6		
UD Indexes	3		
MiSeq Library Prep and Run Costs	6		
DNA Extraction	4		
Promethion	1		
General Lab Consumables	1		
		Total Material Costs	[redacted]

Please provide, in the table below, estimates of other costs that do not fit within any other cost headings

Description and justification of the cost	Estimated Cost
Courier Costs	£[redacted]
Subcontract Sampling Hallmark Meat Hygiene	[redacted]
Hi Seq Sequencing for 250 Samples [redacted]	[redacted]
Total Other Costs	[redacted]

Travel and Subsistence Costs			
Purpose of journey or description of subsistence cost	Frequency	Cost each (£)	Total Cost
Travel to London 2018/19 project initiation	1	[redacted]	
Travel to London 2019/20 wash up	1		
		£ -	£ -

Total Travel and Subsistence Costs	[redacted]

The Pricing Schedule

Proposed Project Start Date	04-Feb-2019	Amount		§ Duration from start of project (Weeks)	§ Duration from start of project (Date)	Financial Year
Invoice Due Date	Description as to which deliverables this invoice will refer to	*Net	** VAT Code			
28-Feb-2019	D1 (submit minutes of project initiation meeting to the FSA)	[redacted]	STD	3	28-Feb-2019	2018-19
31-May-2019	D2 and D3 (submit finalised scope of literature review, summary of Objective 01-2 task 2 and 3, and finalised sampling strategy to the FSA)	[redacted]	STD	17	31-May-2019	2019-20
31-Dec-2019	D4 and D5 (submit summary of 1000 RTE food samples collected and summary of the sequence and taxonomic data present in 1000 RTE food samples to the FSA)	[redacted]	STD	47	31-Dec-2019	2019-20
28-Feb-2020	D7 (submit the first-year progress report to the FSA)	[redacted]	STD	56	28-Feb-2020	2019-20
30-Apr-2020	D6 (Provide a summary of the metagenomic sequence data from a 256 subset of RTE food samples to the FSA)	£[redacted]	STD	64	30-Apr-2020	2020-21

31-Dec-2020	D8, D9 & D10A (Provision of a summary of AMR gene incidence, summary of the risk and uncertainty estimates of dietary exposure to AMR genes and draft final report to the FSA)	[redacted]	STD	99	31-Dec-2020	2020-21
28-Feb-2021	D10B, D11 & D12 (submit to the FSA a revised final report, make the sequencing data publicly available and submit paper to peer reviewed journal)	[redacted]	STD	108	28-Feb-2021	2020-21
Retention/Final Deliverable	***	[redacted]				

Total	£348,356

* Please insert the amount to be invoiced net of any VAT for each deliverable
** Please insert the applicable rate of VAT for each deliverable
*** 20% of the total project budget is withheld and will be paid upon acceptance of a satisfactory final report by the agency.
§The number of weeks after project commencement for the deliverable to be completed

SCHEDULE 5

INVOICING PROCEDURE & NO PO/NO PAY

1. INVOICES SHALL SPECIFY:

- Trading Name of Supplier
- Supplier Address
- Supplier Tel Number/ E mail
- Unique Purchase Order Number – To be advised
- Invoice Number
- Detailed description of the Services provided
- Detailed description of any expenses and the amounts of such
- Location, date or time period of delivery of the Services and/or Deliverables
- Supplier's VAT number
- Amount due exclusive of VAT, other duty or early settlement discount, with the calculation for the charges clearly shown in terms of days and confirmed daily rate
- VAT rate
- Amount due inclusive of VAT and any other duty or early settlement discount
- Date of the invoice.

2. INVOICE SUBMITTAL

Invoicing the FSA:

Please submit invoices to *Accounts-Payable.fsa@sscl.gse.gov.uk* for work with FSA.

Please include the referring FSA purchase order number in the email title and within the invoice to allow Invoice/Purchase Order matching.

Note that invoices that do not include reference to FSA Purchase Order number will be returned unpaid with a request for valid purchase order through email.

3. INVOICE PAYMENT

3.1 The Client shall pay all valid invoices submitted in accordance with the provisions of this Schedule 3 in accordance with the provisions of Clause 7.

3.2 In the event of a disputed invoice, the Client shall make payment in respect of any undisputed amount in accordance with the provisions of Clause 7 and return the invoice to the Supplier within ten (10) Working Days of receipt with a covering statement proposing amendments to the invoice and/or the reason for any non-payment. The Supplier shall respond within ten (10) Working Days of receipt of the returned invoice stating whether or not the Supplier accepts the Client proposed amendments. If it does then the Supplier shall supply with the response a replacement valid invoice. If it does not then the matter shall be dealt with in accordance with the provisions of Clause 18.

3.3 **NO PURCHASE ORDER, NO PAY.**

The Food Standards Agency is currently moving purchasing activity to an electronic purchasing solution. This brings supplier organizations a number of benefits, including limiting purchasing to preferred suppliers and faster payment processing.

To implement the solution, the undernoted changes will be implemented with effect from the contract commencement date.

To prevent unauthorised individuals requesting goods and services only FSA branded Purchase Orders from these email addresses should be accepted as FSA commitment: SSDprocurementagencies@defra.gsi.gov.uk; OR Procurement@foodstandards.gov.uk. The FSA will not pay invoices that do not originate from Purchase Orders from these email addresses.

Any other requests for goods or services from the FSA should be referred to the Procurement Business Partner.

4. CORRESPONDENCE

Correspondence to the Client relating to this Contract (but not the invoice) shall be appropriately referenced and sent to the following address:
Kirsten Stone
Science, Evidence and Research Division
Food Standards Agency
Clive House
70 Petty France
Westminster
London

Correspondence to the Supplier relating to this Contract shall be appropriately referenced and sent to the following address:
Dr Edward Haynes
Fera Science Ltd
Sand Hutton
York
YO41 1LZ

SCHEDULE 6

DISPUTE RESOLUTION PROCEDURE

1. INTRODUCTION

1.1. In the event that a dispute cannot be resolved by the Client and Supplier representatives nominated under Clause 18.2 within a maximum of ten (10) Working Days after referral, the dispute shall be further referred to mediation in accordance with the provisions of Clause 18.4.

1.2. Subject always to the provisions of Clause 21, nothing in this dispute resolution procedure shall prevent the Client or the Supplier from seeking from any court of the competent jurisdiction an interim order restraining the other party from doing any act or compelling the other to do any act.

2. MEDIATION

2.1. The procedure for mediation pursuant to Clause 18 and consequential provisions relating to mediation shall be as follows:

2.1.1. a neutral adviser or mediator ('the Mediator') shall be chosen by agreement between the Client and the Supplier or, if they are unable to agree upon the identity of the Mediator within ten (10) Working Days after a request by one party to the other (provided that there remains agreement for mediation), or if the Mediator agreed upon is unable or unwilling to act, either party shall within ten (10) Working Days from the date of the proposal to appoint a Mediator or within ten (10) Working Days of notice to either party that he is unable or unwilling to act, apply to the Centre for Effective Dispute Resolution ('CEDR') to appoint a Mediator;

2.1.2. the Client and the Supplier shall within ten (10) Working Days of the appointment of the Mediator meet with him in order to agree a programmed for the exchange of all relevant information and the structure to be adopted for negotiations to be held. The parties may at any stage seek assistance from the CEDR to provide guidance on a suitable procedure.

2.2. Unless otherwise agreed by the Client and the Supplier, all negotiations connected with the dispute and any settlement agreement relating to it shall be conducted in confidence and without prejudice to the rights of the parties in any future proceedings.

2.3. In the event that the Client and the Supplier reach agreement on the resolution of the dispute, the agreement shall be reduced to writing and shall be binding on both parties once it is signed by the Client's Head of Procurement and the Supplier.

2.4. Failing agreement, either the Client or Supplier may invite the Mediator to provide a non-binding but informative opinion in writing.

2.5. The Client and the Supplier shall each bear their own costs in relation to any reference made to the Mediator and the fees and all other costs of the Mediator shall be borne jointly in equal proportions by both parties unless otherwise directed by the Mediator.

2.6. Work and activity to be carried out under this Contract shall not cease or be delayed during the mediation process.

2.7. In the event that the Client and the Supplier fail to reach agreement in the structured negotiations within forty (40) Working Days of the Mediator being appointed, or such longer period as may be agreed, then any dispute or difference between them may be referred to the Courts in accordance with the provisions of Clause 41.

SCHEDULE 7

CONFIDENTIALITY UNDERTAKING

1. INTRODUCTION

1.1. This Schedule 7 contains the model confidentiality undertaking to be signed by Supplier in the event of Contract Award.

CONFIDENTIALITY UNDERTAKING

I ***THE SUCCESSFUL TENDERER*** HAVE BEEN INFORMED THAT I MAY BE ASSIGNED TO WORK AS A SUPPLIER IN PROVIDING SERVICES TO THE FOOD STANDARDS AGENCY.

I UNDERSTAND THAT INFORMATION IN THE POSSESSION OF THE CLIENT MUST BE TREATED AS CONFIDENTIAL.

I HEREBY GIVE A FORMAL UNDERTAKING TO THE CLIENT, THAT:

1. I WILL NOT COMMUNICATE ANY OF THAT INFORMATION, OR ANY OTHER KNOWLEDGE I ACQUIRE IN THE COURSE OF MY WORK FOR THE CLIENT TO ANYONE WHO IS NOT AUTHORISED TO RECEIVE IT IN CONNECTION WITH THAT WORK.

2. I WILL NOT MAKE USE OF ANY OF THAT INFORMATION OR KNOWLEDGE FOR ANY PURPOSE OUTSIDE THAT WORK.

I ACKNOWLEDGE THAT THIS APPLIES TO ALL INFORMATION WHICH IS NOT ALREADY A MATTER OF PUBLIC KNOWLEDGE AND THAT IT APPLIES TO BOTH WRITTEN AND ORAL INFORMATION.

I ALSO ACKNOWLEDGE THAT THIS UNDERTAKING WILL CONTINUE TO APPLY AT ALL TIMES IN THE FUTURE, EVEN WHEN THE WORK HAS FINISHED AND WHEN I HAVE LEFT MY EMPLOYMENT.

I HAVE ALSO BEEN INFORMED THAT I WILL BE BOUND BY THE PROVISIONS OF THE OFFICIAL SECRETS ACTS OF 1911 AND 1989. I AM AWARE THAT UNDER THOSE PROVISIONS IT IS A CRIMINAL OFFENCE FOR ANY PERSON EMPLOYED BY A GOVERNMENT SUPPLIER TO DISCLOSE ANY DOCUMENT OR INFORMATION WHICH IS LIKELY TO RESULT IN AN OFFENCE BEING COMMITTED, OR WHICH MIGHT PROVIDE ASSISTANCE IN AN ESCAPE FROM LEGAL CUSTODY OR ANY OTHER ACT AFFECTING THE DETENTION OF PEOPLE IN LEGAL CUSTODY. I AM AWARE THAT SERIOUS CONSEQUENCES MAY FOLLOW FROM ANY BREACH OF THAT ACT.

SIGNED:

NAME:

DATE OF SIGNATURE:

Schedule 8 – Staff Transfer – "TUPE"

Not applicable

Schedule 9 – Commercially Sensitive Information

None identified

Schedule 10 – Variation Notice – Request for Variation

1 General principles of the Variation Procedure

1.1 This Schedule sets out the procedure for instruction and evaluation of Variations to the Framework.

1.2 Under this Variation procedure:

1.2.1 Either party may seek to vary the Service(s) at any time during the Term of the Framework. Each party will do its utmost to give the other reasonable notice of any major changes, preferably a minimum of 3 months notice, and to respond within the timeframe stated in Clause 24.

1.2.2 Variation requests are to be submitted using the format at Appendix A.

1.2.3 Where a Variation is proposed, the Supplier will provide an estimate of the financial/resource implications to the Client, with an estimated timetable for implementation, for the Client's approval.

1.2.4 The evaluation of any Variation is the responsibility of the relevant Director and Head of Procurement, in consultation with the Supplier, in the context of the Review Meetings described in Governance contained in the Framework. The date of implementation of any consequent amendment to the services, and/or payment to the Supplier, will be confirmed in writing by the Client within seven days of the evaluation using the Variation Form at Appendix B.

1.2.5 The Client shall have the right to request amendments to a Variation Request (prior to approval); approve it or reject it. The Supplier shall be under no obligation to make such amendments to the Variation Request; however the Supplier shall not unreasonably refuse such a request. In the event that the Client chooses to reject a Variation Request made by the Supplier the Client shall accept responsibility for the outcome.

1.3 Any discussions, negotiations or other communications which may take place between the Client and the Supplier in connection with any proposed variation shall be without prejudice to each party's other rights under this Framework.

2 Costs

2.1 Each party shall bear its own costs in relation to the preparation and agreement of each Variation.

3 Change Authorisation

3.1 Any Variation and/or amendment to payment arising from a Variation will be executed by the Client's Head of Procurement and confirmed in writing to the Supplier.

3.2 The variation shall not be deemed effective until the Variation form at Appendix B has been signed by both parties.

Schedule 11 – Exit Management

Not Required

Schedule 12 Processing, Personal Data and Data Subjects

1. The Supplier shall comply with any further written instructions with respect to processing by the Client.

2. Any such further instructions shall be incorporated into this Schedule.

Description	Details
Identity of the Controller and Processor	The Parties acknowledge that for the purposes of the Data Protection Legislation, the Customer is the Controller and the Contractor is the Processor in accordance with Clause 1.1.
Subject matter of the processing	No personal data has been identified by the Controller to be managed by the Processor.
Duration of the processing	
Nature and purposes of the processing	
Type of Personal Data being Processed	
Categories of Data Subject	
Plan for return and destruction of the data once the processing is complete UNLESS requirement under union or member state law to preserve that type of data	

APPENDIX A VARIATION REQUEST FORM

Variation **Request No:** **Date:**
Project Title : **Project Ref No:**
Raised By:
Action Proposed:
Full Description of Variation Request:
Area(s) impacted (*Optional*)
Signed By: **Full Name:** Date:
Supplier Contact Details **Supplier Name :** **Contact Name :** **Contact Address :** : : : **Telephone No :** Email Address :

APPENDIX B VARIATION FORM

PROJECT TITLE:

DATE:

VARIATION No:

BETWEEN:

The Food Standards Agency (hereinafter called "the Client") & FERA Science Ltd (hereinafter called "the Supplier")

1. The Contract is varied as follows:

Contract x

2. Words and expressions in this Variation shall have the meanings given to them in the Framework.

3. The Contract, including any previous Variations, shall remain effective and unaltered except as amended by this Variation.

SIGNED:

For: The Client	For: The Supplier
By:	By: . . . . .
Full Name:	Full Name: . . . . .
Position:	Title: . . . . .
Date:	Date: . . . . .

APPENDIX C TABLE OF POLICIES

Table of Policies

Policy	Description	Includes:
Acceptable Use of Computers and Networks	The Food Standards Agency provides networks and equipment to its staff to be used as a source of business information which supports the work of the Agency. Inappropriate use of the Agency's networks exposes the Food Standards Agency to risks including virus attacks, compromise of network systems and services, and legal issues. The Acceptable Use Policy sets out the ways in which the network and systems may be used, safeguarding the FSA and its employees against potential legal action and protecting the security of the Agency's IT infrastructure. It is vital in informing the agency's employees of the behaviour expected of them as users of our Information Technology systems.	- Use of Internet and Intranet - Working Remotely - Personal Web Logs and Websites
Data Protection	The Data Protection Act defines UK law on the processing of data about living people. In order to process personal data and sensitive personal data the Food Standards Agency must comply with the Principles of the Act. Failure to comply could result in the Agency or the individual involved having criminal or civil proceedings brought against them. The Food Standards Agency is committed to protecting personal data and as such the Data Protection Policy was created to safeguard the Agency and its employees by informing staff of their responsibilities and rights when handling personal data.	- Processing Personal Data - Sensitive Personal Data - Failure to Comply - Data Subject
Information and Records Management Policy	Food Standards Agency information and records are valuable assets that play a vital role in documenting the policy making and inspection activities of the Agency. Best practice in records management is vital in supporting the Agency to deliver its strategic plan, document business intelligence, demonstrate accountability and protect its interests. The Information and Records Management Policy informs users of their responsibilities when handling information and records and allows the Agency to maintain a framework of standards to maintain compliance with the Public Records Act 1958, Freedom of Information Act and ISO 27001.	- Organisational Records Management Requirements - Records Standards - Registration Records Management process and System Requirements - Technical specification of records - Access to records - Security of records - Preservation of records
Electronic Communications	The Food Standards Agency provides and encourages the use of its Electronic Communication Systems to its employees for the purposes of business communication. This policy has been developed to ensure the Electronic Communications Systems are safeguarded for the efficient exchange of business information within the Food Standards	- Electronic Mail (Email) - Personal Use - Use of Instant Messaging

	Agency and to ensure that all employees are made aware of their responsibilities and adhere to the relevant legislations.	
Users ICT Security Policy (for all staff)	Security is required to counter threats from external penetration, internal users and environmental events beyond FSA control. Appropriate measures must be in place to control access, preserve the confidentiality, integrity and availability of data and protect each ICT system. In addition the Agency must ensure security standards are maintained to satisfy the requirements of legislation, the HMG Security Policy Framework and industry standards such as ISO27001. This policy defines the FSA security principles and measures to ensure employees understand their responsibilities, managers can identify what is expected of staff and auditors can ascertain that the correct measures are being applied.	- Passwords -Mobile Computing and Remote Access -Virtual Private Networks - Secure Data Storage -Data Backup and Recovery -Workstation Security -Encryption -Software Movements - Security of Equipment Off-Premises -Removal of Property -Secure Equipment Storage and Access
ICT Security Policy (for IT staff ONLY)	This policy is for ISTED staff only The purpose of the policy is as above but with greater detail and extended content in recognition of the increased system access ISTED staff require, and to ensure standards in the development/support/maintenance of our systems are met. It was recognised that detailing the principles that apply to both users and ISTED staff within one length security policy confused the key issues and areas of responsibility and alienated the user audience.	-Mobile Computing and Remote Access -Passwords -Network Security - Perimeter Management -Secure Data Storage -Data Backup and Recovery -Encryption -Agency Software -Software Rollout - Software & Hardware Disposal - Software Movements -Software Audit -Patch Management - Equipment Security -Supporting Utilities -Cabling Security - Equipment Maintenance -Security of Equipment Off-Premises -Removal of Property -Secure Equipment Storage and Access -ICT Systems Security -Control of Development Environments -Change Control - Design and Acceptance of Development -Contingency Planning -Technical Compliance Checking -Technical Review of Operating System Changes
Mobile Voice and Data Policy	The FSA did not have policy for the supply of mobile voice and data tools for Agency staff e.g. Laptops and Blackberries. A policy was needed to allow potential suppliers to give an accurate quote for services, driving better value for money for the FSA. The policy was developed to maximise the efficiency of the mobile voice and data contracts by ensuring that the right people have the right equipment to fulfil their roles. The policy sets out criteria by which these tools are issued together with the a principle that each user will be issued with only one mobile data contract.	-Definition of FSA Remote working tools -Connectivity options - Computer Equipment -Who is eligible -Roles & responsibilities