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Government Chemist Strategy 2017 - 2020

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Executive Summary

The aims of the Government Chemist, GC, function are two-fold:

i) To be an independent referee analyst resolving disputes that occur in relation to the described legislation, and

ii) To be an advisor to government, the public sector and the wider analytical community, where there are measurement science implications of existing and proposed legislation & regulation.

This strategy document supports the Government Chemist programme specification for the period 2017 – 2020 and underpins the longer term development of the programme.

Delivered as part of the Department of Business, Energy & Industrial Strategy (BEIS) National Measurement System (NMS) programme portfolio, the final specification of projects within the Government Chemist programme are reviewed and endorsed by the Government Chemist Programme Expert Group (GCPEG), an independent panel of experts who guide the work of the Government Chemist.

There are five themes within the programme; the GC referee and advisory functions are delivered primarily through the Statutory Function (SF) & Regulatory Foresight (RF) themes respectively, with the Capability Building (CB), Knowledge Transfer (KT) and Programme Management & Development (PM) themes providing the framework within which they operate.

Dissemination and stakeholder consultation are essential components of the programme, to demonstrate the transparency of the GC function, and to share information that enables better measurement science practises, enhanced competitiveness and continued protection of the public in the face of a changing legislative and commercial environment.

This strategy has been developed following a comprehensive stakeholder consultation, to identify the main drivers for the programme going forward, and an extensive horizon scanning activity to identify changes within the regulatory framework within which the GC operates, to highlight potential future demands on the GC function and the effects of scientific advancements on the work we do (the detail of this work is described in the Annex to this document). As a result, the strategic aims have been amended to include keeping under review the implications of possible changes in securing regulatory compliance and the UK's exit from the European Union. New work is proposed to build capability including in molecular biology (next generation sequencing), NMR and protein mass spectrometry. On a more distant perspective ground work is proposed to prepare a future Government Chemist for disputes arising from widespread application of point of use technologies – "the consumer as analyst".

This strategy document seeks to ensure sound governance of the discharge of a continued relevant and effective Government Chemist function.

1. Introduction

1.1 The Government Chemist

The Government Chemist is named as the referee analyst under several Acts of Parliament and regulations made under those Acts. The Government Chemist programme supports the maintenance and development of the capabilities needed to discharge the statutory and advisory functions of the Government Chemist.

The Government Chemist (GC) programme is funded by The Department for Business, Energy and Industrial Strategy (BEIS), with a current annual budget of £1.1M. BEIS is advised by the Government Chemist Programme Expert Group (GCPEG) made up of industry, enforcement and academic stakeholders. The GCPEG has a particular focus in ensuring the efficiency, scientific integrity and sound governance of the GC Programme.

The Government Chemist function is defined in the Government Chemist Agreement [2011], between the Secretary of State for Trade and Industry and LGC. The overarching aim of the Government Chemist function is to provide an independent science-based statutory function and duties described under 16 pieces of legislation (Appendix 1). The BEIS and the Government Chemist act independently of central regulatory departments such as the Food Standards Agency (FSA) or the Department for Environment, Food and Rural Affairs (Defra).

In summary, the Government Chemist function is defined as the following:

- ***Referee Analyst***
  An independent and impartial referee analyst (or *authorised analyst* or *analyst by reference)*, resolving disputes that occur in relation to the described legislation which focuses on public protection, value for money and consumer choice, predominantly in the food and agriculture sectors;
- ***Advisory***
  A source of advice for HM Government and the wider analytical community on the analytical chemical implications on matters of policy, standards and regulations across the public sector.

The impact of the GC programme lies principally in preventing unwitting errors in measurement science that would have adverse impacts on consumers, businesses and the criminal justice system. In addition, it delivers scientific advances and advice to enable the analytical community

to tackle measurement problems that were previously perceived as difficult and so help protect consumer health[1] or consumer choice[2].

1.2 Overview of the Government Chemist Programme

The core responsibility of the programme is the technical appellate (statutory referee analysis) function. Subordinate themes enable LGC to maintain and develop the capabilities needed by the Government Chemist to discharge the function properly and effectively. In addition such themes ensure the effectiveness and independence of advice provided to HM Government and the analytical community. The programme is funded in three-year cycles and historically has been based around five main themes, in proportions detailed in Table 1. Each theme contains a number of activities or projects which allow LGC to fulfil the Government Chemist function. It is proposed that the relative proportions of the themes, whilst amended slightly from previous programmes to prepare the future Government Chemist, remain largely similar for the GC Programme 2017-20:

Theme	% 2011-14	% 2014-17	% 2017-20
Regulatory Foresight (RF)	18	20	17
Capability Building (CB)	20	20	22
Statutory Function (SF)	39	40	41
Knowledge Transfer (KT)	13	10	12
Management and Development (PM)	9	10	8

Table 1 Themes within the GC Programme, upon which projects are based.

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[1] For example a GC peer reviewed scientific paper on food choking hazards now serves as guidance for regulators, enforcement (in public analyst laboratories) and the trade: Analytical Strategy for the Evaluation of a Specific Food Choking Risk, a Case Study on Jelly Mini-Cups, Michael J. Walker, Peter Colwell, Derek Craston, Ian P. Axford and Jack Crane, 2012, *Food Analytical Methods*, (, 5, 54-61

[2] For example the GC team produced a novel PCR DNA means of distinguishing closely related species: Nixon, G., Hall, L., Wilkes, T., Walker, M. and Burns, M. (2016) Novel Approach to the Rapid Differentiation of Common *Prunus* Allergen Species by PCR Product Melt Analysis. *Food and Nutrition Sciences*, **7**, 920-926

1.3 Description of Themes

The Regulatory Foresight (RF) theme provides the Government Chemist with the necessary knowledge and contextual information to discharge the function. In addition this theme provides high quality advice and effective strategies for analytical science to Government and other stakeholders on the analytical measurement implications of new regulations and legislation. Horizon scanning or foresight, e.g. regular quarterly reviews of legislation, meetings with key stakeholders and responding to official consultations from HM Government and the EU are some of the activities undertaken in the RF projects.

The Capability Building (CB) theme ensures that the Government Chemist has the necessary capability to undertake referee analyses over the medium term reflecting changes in legislation identified under the RF themed projects, advances in analytical technology and actual, or likely, threats/emerging issues.

The Statutory Function (SF) theme supports referee analyses and directly related activities, such as method development, attendance at court as an expert witness and participation in proficiency testing (PT) schemes. Expenditure is largely demand led.

The Knowledge Transfer (KT) theme is used to advance the Government Chemist's standing within its representative analytical communities, fundamentally, but not exclusively, official food and feed control analysts. KT keeps stakeholders informed of the impact of key regulatory and analytical developments. Effective KT ensures that the knowledge gained through referee casework, which often occurs at the most problematic interfaces between science and legislation, helps prevent future disputes in these areas. Additionally, KT demonstrates the scientific credibility and authority of the Government Chemist.

The Programme Management and Development (PM) theme provides overall management of the programme and supporting activities including formal reporting to Government, external scrutiny and advisory mechanisms.

Figure 1 shows how the different elements of the programme combine to effectively deliver the referee function and how this work draws on the capability of the National Measurement Laboratory and Designated Institute work carried out within LGC.

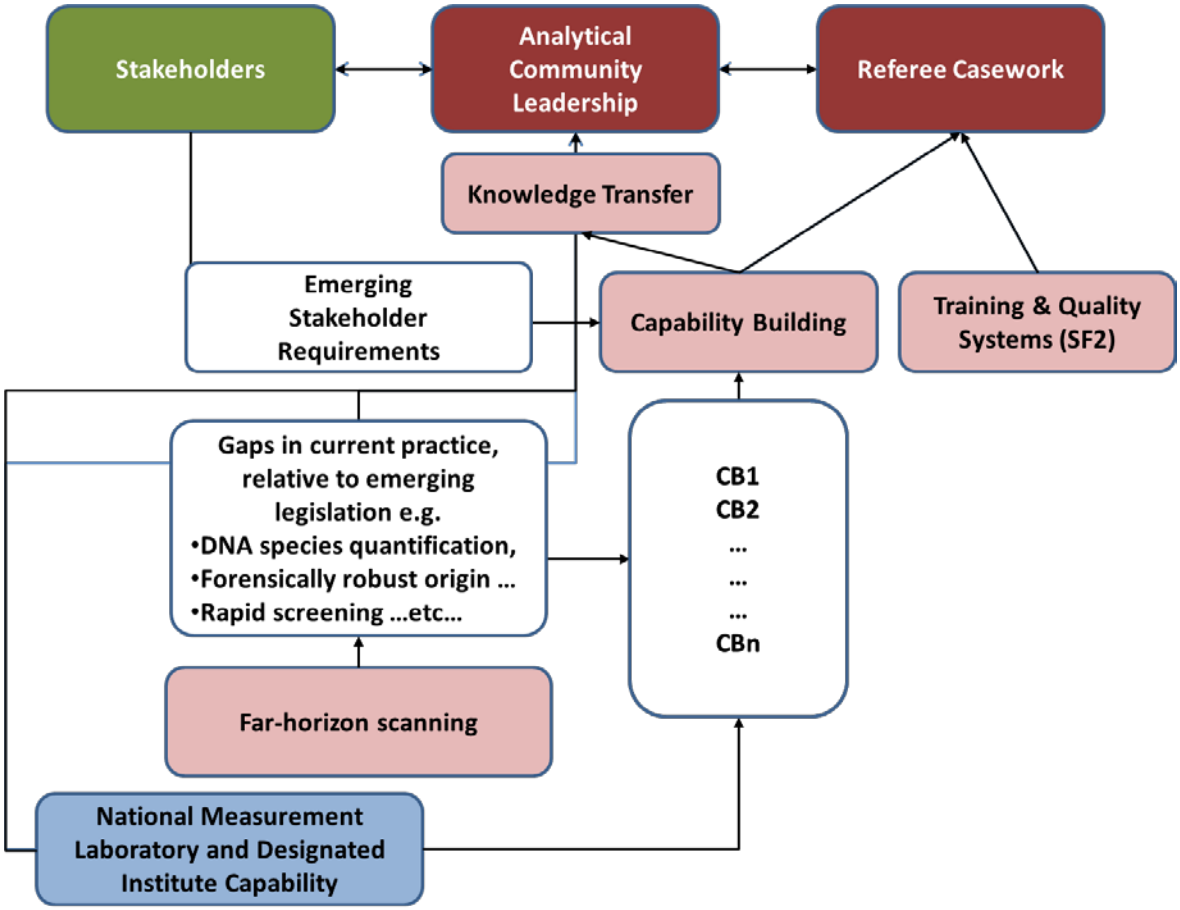

Figure 1: Schematic showing the contributing elements that effectively deliver the Government Chemist referee function

2. Stakeholder Engagement

Excellent progress was made in the 2014-2017 GC programme, working to the Government Chemist Knowledge Transfer and Dissemination plan, to demonstrate the transparency of the GC function, share information and consult stakeholders. Examples of this include the annual Government Chemist reviews, continued success of the two-day biannual programme conference (150 & 120 delegates for 2014 and 2016 respectively) focused on food policy and analysis (which brings together the main players in regulatory policy development and measurement science), and continued knowledge sharing and dissemination through peer reviewed publications, presentations and joint stakeholder workshops. The update and transfer of the GC website to the gov.uk platform also increased the visibility of the work carried out with a 15-fold increase in site hits per month, to reach 2,000 hits per month. In addition the profile of the GC has been increased through representation GC at relevant meetings, committees and the success of complementary activities such as LGC overseeing DEFRA's Food Authenticity Network, thus broadening the outreach of the GC programme. This programme will continue with an outreach strategy focusing on stakeholder groups that are key for Government Chemist engagement; this will include the:

- Government Chemist website
- Government Chemist conference
- Government Chemist stakeholder event – advisory
- Annual MChemA residential course
- APA Training Officer role
- Government Chemist Project Expert Group
- Government Chemist review
- Peer review publications
- Contributed articles (not peer reviewed)
- Representation on committees, and stakeholder engagement
- Direct contact – meetings, casework, advice and enquiries
- Oral presentations at meetings, seminars and conferences
- Complementary activities, e.g. overseeing DEFRA's Food Authenticity Network
- Developing more governmental links with the advisory function.

Key target stakeholder groups continue to include:

- Regulators and Enforcement Officers
- Industry through trade organisations
- Professional bodies
- Government Departments
- Research organisations.

Other Referee bodies in Europe and beyond are detailed in Appendix 2 which presents a list of stakeholder categories and their representative bodies.

A good illustration of the long term commitment of the Government Chemist to support and learn from the activities of related stakeholders includes:

- The Government Chemist, Dr Craston, sits on a range of committees including
    - IUPAC - the International Union of Pure and Applied Chemistry
    - Innovation Strategy Board in to the chemicals KTN in innovate UK
    - AIRTO, The Association for Innovation, Research and Technology Organisations
    - The Chemical Weapons Convention (CWC) Advisory Committee
    - GBSI - Global Biological Standards Institute - Scientific Advisory Board
- The Defra/FSA Authenticity Methods Working Group (AMWG), is chaired by the Deputy Government Chemist, Selvarani Elahi
- Selvarani Elahi is also *ex officio* a member of the Defra/FSA Authenticity Steering Group (ASG)
- Dr Malcolm Burns, Principal Scientist, Molecular Biology & Special Adviser to the Government Chemist is a member of an AMWG sub-group reviewing DNA methods tackling authenticity issues and their fitness for purpose
- Selvarani Elahi is a member of the Royal Society of Chemistry's MChemA Examinations Board
- Michael Walker, as Training Officer to the Association of Public Analysts (APA), sits on the APA Training Committee
- Michael Walker also sits on the IFST Science Committee, is an observer at the Local Government Food Standards and Labelling Focus Group and, in a personal capacity, chairs the FSA Northern Ireland Strategic Committee on Food Surveillance and the Virtual Food Authenticity Network management committee
- LGC serves a number of National Reference Laboratory functions including
    - UK NRL for GMOs in Feed and Food (Dr Malcolm Burns)
    - UK NRL for Feed Additives (Kirstin Gray).

Note: Not all of the above activities are funded by the Government Chemist Programme.

3. Strategic Aims

Informed by the horizon scanning considerations set out in Annex 1 and the Stakeholder consultation exercise described in Appendix 3, a set of strategic objectives has been drawn up for the next 3 year Government Chemist Programme 2017-20.

Statutory Function (SF), Regulatory Foresight (RF) & Capability Building (CB)

A continued relevant and effective Government Chemist function, delivered by:

- Definitive resolution of increasingly more complex referee cases in a timely manner in line with our submissions policy;
- Capability building that reflects awareness of identified priorities informed by effective horizon scanning;
- Investment in new technologies, and training for a core skill base to deliver the programme efficiently and to the required high standard;
- Maintenance of appropriate quality systems;
- Increasing emphasis on dispute avoidance by working with partner organisations such as FSA, Defra, FSS, DH and local government, including trading standards and environmental health officers;
- Keeping under review legislative developments in the UK's exit from the EU;
- Keeping under review developments in machinery of Government, and strategic changes in securing regulatory compliance.

Knowledge Transfer (KT)

Share our knowledge of measurement science to support consumer protection, better regulation and enhanced competitiveness, delivered by:

- Maintaining stakeholder awareness of the role and benefits of independent and impartial dispute avoidance and resolution;
- Maintaining the advisory role on sound measurement science in a strategic and holistic manner;
- Maintain meaningful dialog with stakeholders and regulators in areas that link measurement and regulation, as well as look to expand to include closer links with other government departments such as the MOD & home office,

- Ensuring key regulatory and analytical developments, and knowledge gained during referee analysis, continue to be transferred effectively to the relevant parties using the more recent technological advances in web-based seminars and through increased use of the Government Chemist website;
- Peer reviewed scientific publications;
- Presentations given at relevant scientific conferences;
- Presence on relevant government and other working groups.

Programme Management and Development (PM)

Maintain sound governance of the discharge of the Government Chemist function and office, for example, by:

- Adherence to an agreed policy on the avoidance and management of potential conflicts of interest; in line with our submissions policy agreed by the PEG;
- Continue to enhanced project management of capability building work with SMART, tight objectives and mid-term review;
- Working constructively with the sponsor department (BEIS) and the GCPEG;
- Efficient and effective programme management.

Annex 1 Considerations

Annex 1- 1 Regulatory Foresight: Statutory Function (Enforcement and Referee Analysis)

The Government Chemist operates within a complex regulatory framework which faces major challenges over the coming years. These have been considered in formulating the programme strategy.

Annex1-1.1 The Regulatory Framework

Food and animal feed must be safe, authentic and properly labelled, the responsibility for which falls to those who make and sell it.[3] There is, however, a public expectation of regulatory oversight by government which is addressed by domestic legislation and embedded in European law insofar as it continues to apply to the UK. In the UK the defining Act of 1875 that introduced much of modern food regulation including the Government Chemist role has been regularly updated. The current equivalent measure, the Food Safety Act 1990, provides the enabling powers under which all food regulations, including those on food labelling, are made. Food law in the UK is largely criminal law in which the burden of proof on the prosecution is one of beyond reasonable doubt. This is translated in analytical chemistry in a number of ways - mainly as a 95% confidence interval of the expanded measurement uncertainty below the mean when appraising a result against a maximum limit. The main criminal offences in the Food Safety Act 1990 are rendering food injurious to health (Section 7), selling, to the purchaser's prejudice, food which is not of the nature or substance or quality demanded (Section 14) and falsely or misleadingly describing or presenting food (Section 15). Increasingly, though, new approaches are being introduced by the inspector such as the use of 'improvement notices' (IN) if they believe a health and safety law has been broken. This allows flexibly securing compliance and for which the criminal sanction would only be made when there is failure to comply with the initial IN.

The Food Safety Act 1990 and the Agriculture Act 1970 combine to protect public safety and also ensure that food products are properly labelled and described. These Acts also set out the function of the GC as the referee analyst. Food safety and authenticity work dominate the

[3] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety (OJ L 31, 1.2.2002, p. 1),

workload of the GC, although a similar role for the GC is established by other acts including the Hydrocarbons Oil Duties Act 1979.

As a result of the UK vote to leave the EU the continued operation of the body of law built up at EU level in food and feed must be considered, however until the UK actually leaves the EU this body of law will still be effect. To remove EU obligations from UK law the Government will no doubt repeal the European Communities Act 1972. It is important to recall however that much EU food law originates at global level in the *Codex Alimentarius* hence global trading and consumer protection will require legislation to like effect to be retained. The most convenient manner in which to bring this about may well be to retain secondary legislation implementing EU law, and directly applicable EU Regulations so that a seamless transition as regards food safety and standards is accomplished.

The two key pieces of EU legislation are Regulation (EC) 178/2002 and Regulation (EC) 882/2004. The former lays down the general principles and requirements of food and feed law, with Regulation (EC) 882/2004[4] designed to augment existing legislation on official control of food and feed by a harmonised Community approach to the design and implementation of national control systems. Regulation (EC) 882/2004 also seeks to prevent, eliminate or reduce to an acceptable level risks which may arise, either directly or via the environment, for human beings and animals; to guarantee fair practices as regards trade in food and feed and the protection of consumers' interests, including labelling. Article 33 of (EC) 882/2004 also set up a network of European Union Reference Laboratories (EU-RLs) and the requirement for individual Member States to designate one or more National Reference Laboratories (NRLs) for each EU-RL. This network provides technical and scientific support for the EU official control framework. Regulation (EC) 882/2004 has been in application since 1 January 2006 and is currently. under review. One likely consequence is that where financial penalties are used in relation to intentional violations of food chain law, they should be at a level which is sufficiently dissuasive for example higher than the economic gain expected from any fraud. The much stiffer penalties available to the courts for breaches of food safety and food hygiene regulations as a consequence of new guidelines from the Sentencing Council applicable from 1 February 2016 also reflect heightened concern around food.[5] . It is proposed to alter the financing of official controls under 882/2004, with the funding possibly shifting from the taxpayer to the industry.

The regulatory landscape in the UK is a complex one, with policy set by central government and enforcement mainly a local government responsibility. The Food Standards Agency (FSA) is the

[4] Regulation (EC) No 882/2004 of The European Parliament and of The Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules (OJ L 165, 30.4.2004, p. 1)

[5] https://www.sentencingcouncil.org.uk/wp-content/uploads/HS-offences-definitive-guideline-FINAL-web.pdf

central competent authority, the government department responsible for all issues concerning the safety of food, including the more detailed legislation which specifies, for example, maximum limits for contaminants in food. Most of this legislation implements directives and, increasingly, regulations agreed by the EU. In 2010 the government transferred responsibility for food labelling and food composition policy (where not related to nutrition or food safety), in England, to Defra. Arrangements in Scotland and Northern Ireland remained as they were. Also in 2010 responsibility for nutrition policy transferred from the Food Standards Agency to the Department of Health in England and to the Welsh Assembly Government in Wales.

On 13 January 2015 the Food (Scotland) Act 2015 created Food Standards Scotland (FSS), or in Gaelic, Inbhe-Bidhe Alba, as a new, independent body which will replace the UK-wide Food Standards Agency in Scotland. The Act sets out key aspects of the relationship between the Scottish Ministers and FSS. The Scottish Ministers may request advice and assistance from FSS in relation to particular matters and may give FSS directions in certain circumstances. The food and feed law provisions mirror those of the Food Standards Act 1999 that set up the Food Standards Agency, however new provisions include: provision for a food hygiene information scheme, an offence of failing to report suspicion of food not being compliant with food information law (e.g. mislabelled food), and powers for authorised officers to detain or seize and remove such food and for a sheriff to determine the treatment of such food. New administrative sanctions were introduced such as compliance notices and fixed penalties so that offences can be dealt with more quickly and at less cost than prosecution. Food Standards Scotland was made a non-ministerial office of the Scottish Administration and took on its responsibilities formally on 1 April 2015. FSS will provide Scotland with regulation and independent advice on food safety and standards, food information and nutrition.

FSA retains responsibility for central policy on *enforcement* in England, including across areas where *policy* transferred to Defra and DH, however day to day enforcement of food legislation is mainly the responsibility of local authorities. FSA works closely with local authorities to improve co-ordination of enforcement activities. At the sharp end of regulatory enforcement are the Trading Standards Officers (TSOs), Environmental Health Officers (EHOs) and Port Health Officers (PHOs) who are employed by local authorities. Between them they constitute the largest enforcement service in the UK by number, though not by budget. Increasingly enforcers are joining forces to undertake survey programmes to provide the data to inform risk analysis, sometimes initiated by themselves and sometimes by regulators. In recent years, their enforcement activities have become dominated by two themes, putting risk assessment at the heart of regulatory activity and an evidence-based approach to set national priorities for policy areas enforced by local authorities. From these came the concept that inspection and enforcement should be intelligence-led, and resulted, prior to 2013, in a reduced priority for food standards (authenticity and labelling) as opposed to food safety. Against this background, front line enforcers face the pressures that their actions must stand up in a court of law, yet their

budgets are increasingly under review. There is therefore a real demand for tools to reinforce intelligence-led enforcement, such as low cost Point of Use (PoU) analytical devices and although this has not yet been realised horizon scanning (see Annex 1.3) has emphasised this as a key topic for GC investigation.

The Elliott Review final report following the horse meat scandal was published in September 2014. The review took a systems approach based on 'eight pillars of food integrity', making clear that no one element can stand alone. The result is a robust system that puts the needs of consumers before all others; adopts a zero tolerance approach to food crime; invests in intelligence gathering and sharing; supports resilient laboratory services that use standardised, validated methodologies; improves the efficiency and quality of audits and more actively investigates and tackles food crime; acknowledges the key role Government has to play in supporting industry; and reinforces the need for strong leadership and effective crisis management. The report and interdependent recommendations form the basis of a national food crime prevention framework with clear roles and responsibilities for Government and industry. Under each recommendation there are detailed actions for various stakeholders.

The Governments response[6] was wholly supportive of the recommendations in the Elliott Report and in particular highlighted the importance of:

- setting up a new Food Crime Unit
- ensuring a resilient network of food analytical laboratories to test food consistently
- improving coordination across government to protect food integrity and tackle food crime

From the Government Chemist's point of view three of the most far reaching outcomes arising from the Elliott Review are (a) the creation of a new Food Crime Unit hosted by the Food Standards Agency, (b) development of 'Centres of Expertise' in food authenticity, creating a framework for standardising testing and (c) local authorities with their own laboratories forming an integrated shared scientific service around food standards working in partnership with Public Health England.

FSA's 2015-20 strategy focuses on the role that the FSA plays in delivering 'food we can trust' and recognises the critical importance of working in partnership with others to protect consumers' interests in relation to food. . A key component of the FSA's strategy is an effective, robust and proportionate system of ensuring that food businesses comply with the regulations put in place to protect consumers' interests. Development of a new compliance model is a priority for the FSA, embodied in the 'Regulating our Future' programme that envisages radical rather than

[6] https://www.gov.uk/government/publications/elliott-review-of-the-integrity-and-assurance-of-food-supply-networks-government-response

incremental change. FSA has identified five principles that form the core of discussions with stakeholders:

1. Businesses are responsible for producing food that is safe and what it says it is, and should be able to demonstrate that they do so. Consumers have a right to information to help them make informed choices about the food they buy – businesses have a responsibility to be transparent and honest in their provision of that information
2. FSA and regulatory partners' decisions' should be tailored, proportionate and based on a clear picture of UK food businesses
3. The regulator should take into account all available sources of information
4. Businesses doing the right thing for consumers should be recognised; action will be taken against those that do not
5. Businesses should meet the costs of regulation, which should be no more than they need to be.

Sampling and analysis are key features of enforcement of official controls and within the UK, the official food and feed control laboratories[7] ("the OCL system") provide the underpinning measurement science in a range of laboratory facilities; the chemical aspects of food and feed safety, composition and labelling are dealt with by Public Analysts and Agricultural Analysts (generally the same person). The responsibilities of Public Analysts (particularly in Scotland), also include acting as Food Examiners dealing with microbiological safety and quality. Public Analysts and Agricultural Analysts are represented by the Association of Public Analysts (APA).[8]

As a consequence of the Elliott Review significant steps have been taken to consolidate local authority owned Public Analyst provision. Coupled with the potential scalability of response and advanced techniques now deployable by all, especially the private sector Public Analysts with their global perspective, the Public Analyst service as a whole has never been better equipped to tackle modern technical challenges. Government Chemist knowledge transfer must continue to play a part in nurturing and guiding the service.

Since inception in the 19th century the UK regulation of food and feed, has provided safeguards to the consumer. The formal control sample is split into (at least) three equivalent portions so that a food or feed business may have a counter-analysis carried out to be compared to that carried out by the OCL. Should a dispute arise between the official and the counter-analysis a retained

[7] Food Standards Agency, 2012, List of official feed and food control laboratories in the UK, available at http://www.food.gov.uk/enforcement/monitoring/foodlabs/foodcontrollabs (accessed 13.11.2012)

[8] Association of Public Analysts, APA, http://www.publicanalyst.com/ (accessed 05.08.2012)

portion of the sample may, in statutorily defined circumstances, be submitted to the Government Chemist for a definitive investigation, see Figure 2.[9]

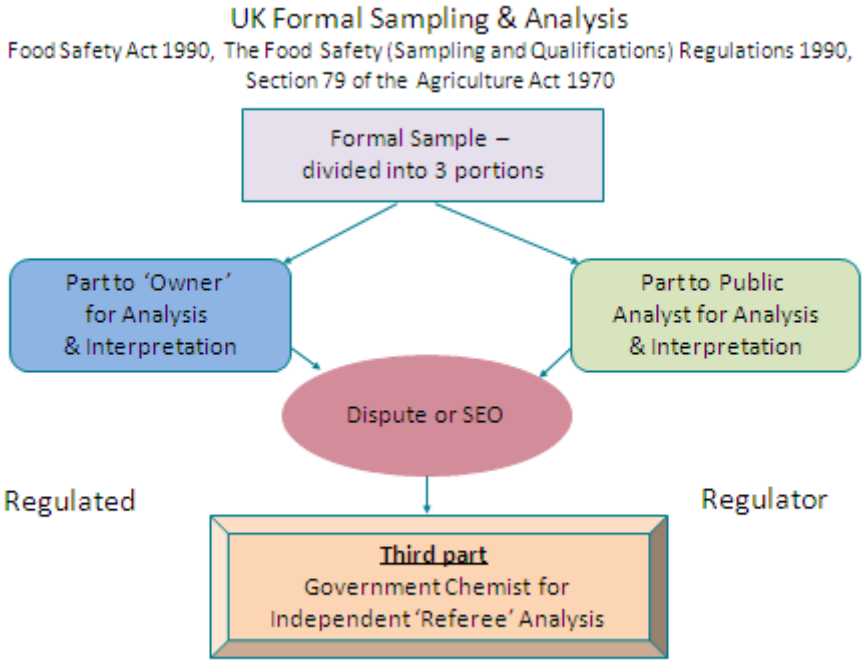

Figure 2 Arrangements for Referee Analysis

The Government Chemist Programme[10] at LGC[11] provides a statutory-based route of technical appeal to prevent or resolve measurement disputes prior to costly processes in the criminal justice system; this is the 'referee function'.[12] The need for referee analysis often arises in novel or complex interfaces between science and the law, hence considerable synergy is provided by the assignment of LGC as the UK's designated National Measurement Institute for chemical and bioanalytical measurement, giving access to fundamental measurement science research and advanced instrumental techniques.[13] Referee analysis is also recognised at European level as

[9] UK Government, Food Safety (Sampling and Qualifications) Regulations 1990 No. 2463 with devolved equivalents

[10] Government Chemist Programme: http://www.governmentchemist.org.uk/Index.aspx (accessed 05. 08.2012).

[11] LGC Ltd, formerly the Laboratory of the Government Chemist, http://www.lgc.co.uk/ (accessed 12.11.2012)

12 Boley, N, 2012, Government Chemist Legislation - Annual statement of statutory scope (January 2012) available at http://www.governmentchemist.org.uk/Generic.aspx?m=77&amid=1401 (accessed 09.11.2012)

[13] National Measurement System Chemical and Biological Metrology, http://www.nmschembio.org.uk/ (accessed 09.11.2012)

supplementary expert opinion (SEO) pursuant to Article 11(5) of Regulation (EC) 882/2004 on official controls.

Globally, too, the role of Government Chemist is replicated for example in Hong Kong, as in LGC, alongside the national chemical metrology institute (NMI) and in New Zealand, Kenya and Jamaica.

Annex1- 1.2 Horizon Scanning - Future Demand for Referee Analysis

Number and Type of Referee Cases

It might be expected that numbers of referee cases would be linked to levels of enforcement sampling, however over the past two programmes as sample numbers at local authority level have fallen the number and complexity of referee cases has been maintained, although the range and complexity of cases has increased from all previous programmes. There are at least five possible reasons for this:

1. increased emphasis on food authenticity following the Elliott Review,
2. the increased sophistication of techniques routinely available to Public Analysts, for example advanced hyphenated techniques and NMR and the consequent need for independent review of the data produced;
3. reduced capacity and corporate memory of food standards in local and central government leading to increased demand for GC advice where a reservoir of experience is maintained
4. although formal food and feed sampling continues to decline the *proportion* of samples found to be unsatisfactory has increased; this may be attributable to more sampling being undertaken on a risk based basis, and
5. the increased globalisation of trade with consequent scrutiny of imported food.

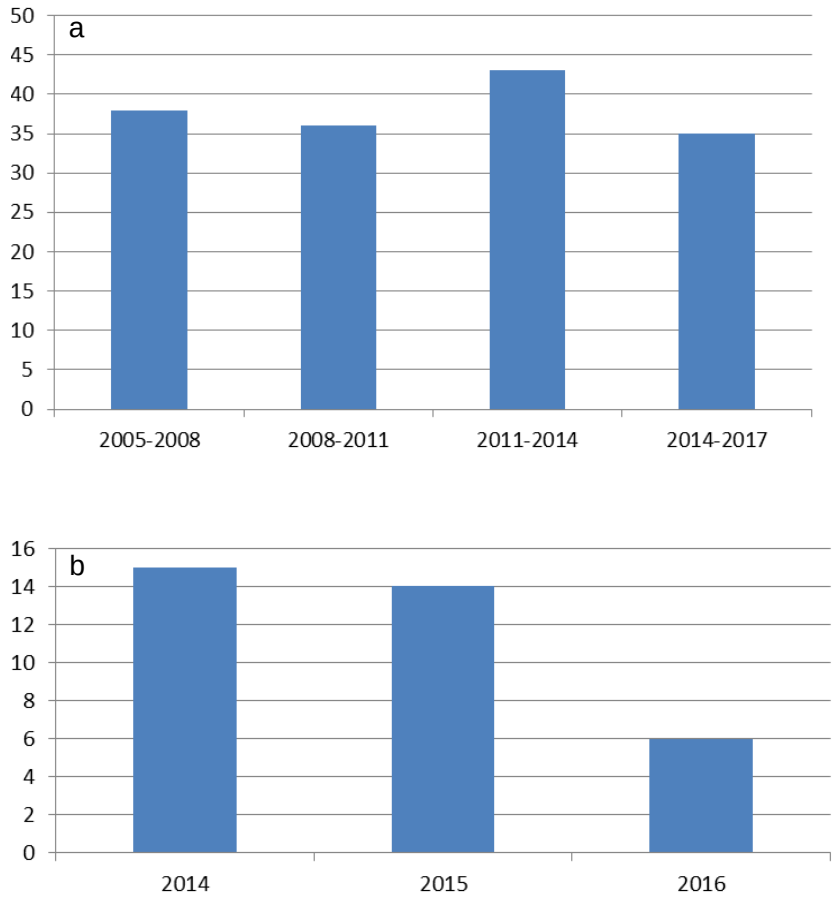

Figure 3: Referee cases received a) by programme, b) ***to mid-September 2016*** *in the 2014-2017 programme, grouped by year received.*

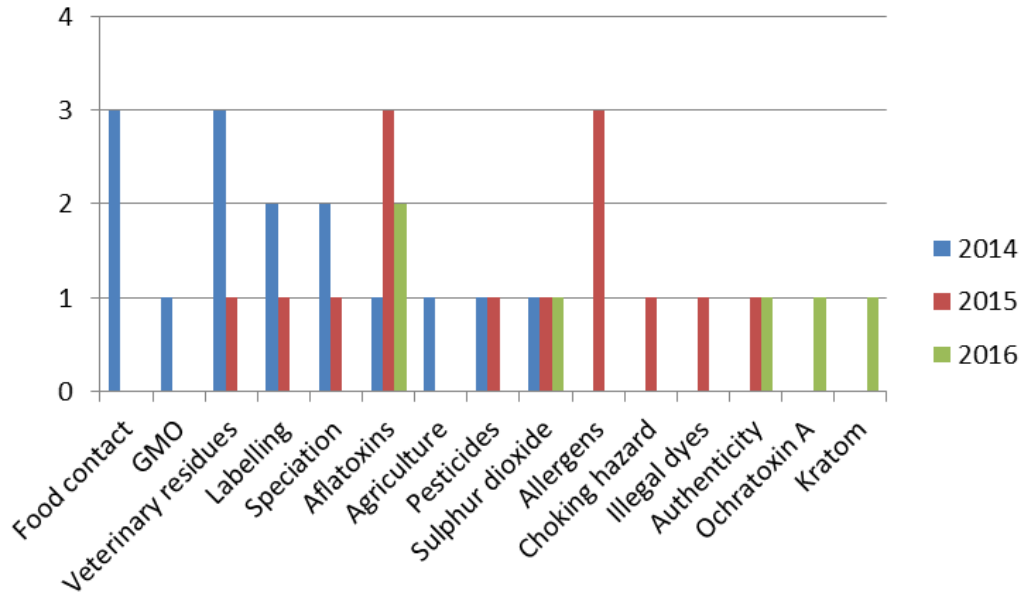

Figure 4: Referee cases received to date in the 2014-17 programme, by year and analytes.

Annex1-1.3 Science and Technology

The pace of current scientific change defies an overarching analysis of its implications for the GC programme. Moreover, the programme is inextricable bound to the National Measurement Laboratory (and Designated Institute for chemical and bioanalytical measurement), which is co-located at LGC, and to the strength-in-depth exhibited by LGC in modern measurement science. Recent knowledge transfer events on DNA sequencing and referee work on cumin and paprika, GMO, veterinary residue and pesticides exemplify this. Traditional bench skills and statistical analysis continue to play a vital role, as does our experience in vitamin analysis, nitrogen factor interpretation and mass spectrometry approaches (especially for protein quantification). Two complimentary strands of policy need to be considered: the science and technology required (a) to deliver our referee role and (b) to provide leadership and guidance to the analytical community on best measurement practice. Through our horizon scanning activity (see below Annex 1.3) and close links with key stakeholder groups, we have identified the following priorities for the short, medium and long term future.

Food Labelling

Regulation 1169/201114 on the provision of food information to consumers introduced changes that are still being felt, including:

- Origin labelling of fresh meat from pigs, sheep, goats and poultry;
- Certain allergens must be highlighted in the list of ingredients - information on allergens also cover non pre-packed foods, including those sold in restaurants and cafes;
- “Nanomaterials should be clearly indicated in the list of ingredients - names should be followed by (nano)”

Geographic provenance can be investigated by looking at how trace elements and isotopic ratios differ when ingested by an animal from the water it drinks and from the soil where its feed is grown. Molecular biology approaches using DNA markers are also being increasingly used to great effect for geographic traceability, as evidenced by published papers and results from national and international fish traceability projects (e.g. LABELFISH, FISH-BOL, FishPopTrace). Thus by a combination of approaches much can be done scientifically to probe and police geographic origin of high value foods.

[14] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004

Novel separation approaches combined with existing mass spectrometry techniques are also in development for the measurement of size distribution and elemental composition of engineered and non-engineered nanomaterials.

Other key areas of science and technology that are thought to impact upon the 2017-20 programme include gaps in DNA quantification of species, the forensic robustness of existing techniques for provenance authentication (DNA, trace element and isotopic, proteomic and related approaches), rapid screening for wider authenticity, and well characterised protein allergen quantification.

An overarching theme is that enhanced metrology will be required in food and feed safety and authenticity in the future, making measurements more accurate through better understanding of measurement uncertainty and the use of the most suitable reference materials. This is particularly relevant in global markets in reducing unnecessary barriers to trade. A particularly stark example of the huge gap that exists between current practice in the analytical community and validated traceable measurement approaches lies in food allergen analysis. Eventually, it is likely that allergen 'threshold levels' will be formalised in guidelines or in law, but although this is beginning to be addressed internationally, currently only a limited measurement framework exists for metrologically traceable allergen quantification[15].

More routinely, to prepare for possible referee cases on more diverse mycotoxins, stemming from FSA nationally prioritised sampling exercises, GC mycotoxins analysis should include such compounds as sterigmatocystin and citrinin in addition to masked mycotoxins. The latter, conjugated or non-extractable mycotoxins, which may be converted to the toxic form in the mammalian gut and could in the future, be controlled by maximum limits.

Modern molecular biology approaches (including PCR, real-time PCR, traditional Sanger DNA sequencing, digital PCR, etc.) can be applied for food testing to ensure consumers are able to make informed choices on the food they eat. Core capability in this area in referee cases has proved indispensable and must be consolidated and built upon. Moreover there is evidence of a need for guidance on new and emerging approaches for food analysis (e.g. digital PCR); development and validation of novel assays for specific species detection in samples of topical

[15] Walker, Michael John, Duncan Thorburn Burns, Chris Elliott, M. Hazel Gowland, and E N Clare Mills, 2016, Flawed food allergen analysis–health and supply chain risks and a proposed framework to address urgent analytical needs, *Analyst*, 141, 24 – 35

importance (e.g. almond in cumin); scoping of bioinformatics related approaches to provide improved confidence in DNA sequencing and DNA databases; and in the longer term, assessment of approaches for detecting products of new (plant) breeding techniques and products of synthetic biology (e.g. by CRISPR genome editing).

Looking to the future, Next Generation Sequencing (NGS) represents a powerful tool for rapidly and cost-effectively identifying and characterising component species (microbial, plant or animal) from simple or complex mixtures using massively parallel DNA sequencing. It is being used increasingly in the area of food testing for species identification, metagenomics (population of bacterial genomes for food quality and/or UK Protected Designation of Origin of foods) and meta-barcoding (meat/plant species identification using genetic markers). Thus the Government Chemist should aim to develop and maintain demonstrable competency in NGS through involvement in laboratory-based work, sharing of best measurement practice with other expert UK stakeholders, and providing guidance and recommendations on how to implement NGS and interpret its outputs**.**

Horizon scanning by the GCPEG clearly identified the need for GC interest in disruptive point-of-use technologies which may generate referee work in the medium and long term future. The ability to analyse multiple food samples and species simultaneously using definitive laboratory-based analytical instrumentation is underpinned by cost-efficiency and delivery drivers, but capability building is required in rapid, non-targeted multi-analyte methods capable of effecting transition from the laboratory to the field and to provide best practice for their use, for example emerging optical techniques such as multispectral imaging (MSI) and mass spectrometry coupled to ambient ionisation. Multispectral imaging (MSI) is a true non-targeted, multi-analyte technology, offering the benefits of a non-destructive approach, integrated analysis, and quantitative potential. Currently laboratory based, MSI may also be suitable for future transition to field use. Ambient ionisation coupled to mass spectrometry (MS), offers the potential for rapid testing of complex samples to enable both qualitative and quantitative analysis. Additionally, recent developments in smaller/cheaper instrumentation have enabled the possibility of establishing tests outside of the laboratory environment (at point-of-test). This can potentially be used to detect both adulteration and contamination in food and drink. Building capability now in these techniques will pave the way for future progress to prevent or resolve disputes arising from widespread application of point of use technologies – “the consumer as analyst”.

An area of increasing concern, also highlighted by the GCPEG, is around food supplements and novel ingredients and foods. The detection of adulteration in these areas relies on both targeted and un-targeted analysis. For example, ‘chondroitin’, a glycosaminoglycan consisting of repeating sugar units, is a natural product isolated from parts of either land animals or fish and is taken for the treatment of arthritis. Chondroitin is not a well-defined substance but one which falls

into the class of materials with an unknown or variable composition (UVCB) the characterisation of which has caused problems for analytical chemists. Characterisation of chondroitin requires structurally sensitive analytical techniques e.g. liquid chromatography after specific enzymatic hydrolysis, MS, NMR IR or Raman spectroscopy coupled with chemometric data evaluation. Supplements are also at risk from contamination on a global scale with illegal ingredients for which chromatographic and mass spectrometric techniques are applicable and high field NMR would appear to be an excellent first-line method of control. Similarly, novel foods are frequently found in supplements and the analyst requires methods for either known marker compounds or compound specific detection for their identification. Examples, by way of illustration, include *Acacia rigidula,* a shrub the leaves of which are extracted to yield an illegal weight loss product or agmatine sulphate, a decarboxylated arginine to which wide lifestyle and cognitive claims are attached although not authorised as a novel food. Capability building in these areas will prepare the GC for immediate and longer term issues.

Annex1-2 Regulatory Foresight: Advisory Function

The Government Chemist is a source of advice for HM Government and the wider analytical community on the broader analytical chemistry implications, on matters of policy, standards and regulation. This is achieved by identifying and fulfilling the requirements of stakeholders, such as Government departments and agencies, local authorities and regional public analysts, businesses, trade association's, members of the public and special interest organisations, by issuing pertinent evidence based advice.

The Regulatory Foresight work provides an advisory function through horizon scanning or foresight and information gathering, with focus on the key areas of health & safety, sustainability and nanotechnology as set out in the NMS strategy. This information is then used to respond to consultations and calls, participate in key stakeholder groups and direct a number of small scale studies on areas of potential interest.

The situation following the recent referendum decision for the UK to leave the EU causes uncertainty but once Article 50 of Lisbon Treaty is invoked, the UK will have to consider it's a chemicals policy outside of an EU regulatory framework. In the meantime existing arrangements will remain where EU legislation continues to drive changes to the regulatory landscape where chemical measurement is essential in allowing industry to demonstrate compliance and enabling government agencies to take enforcement action.

Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP) are intended to ensure a high level of protection of human health and the environment as well as the free circulation of substances on the internal market while enhancing competitiveness and innovation. REACH has had a phased registration of all chemicals manufactured or imported into the EU. Subsequently the process of evaluation, authorisation and setting new restrictions will intensify where new data from the registration process will be used but will be dependent on accurate identification (nomenclature) of substances and mixtures as well as compositional information. This has been identified by the European Chemicals Agency (ECHA) who have responsibility for the operation of REACH in their *Report on the Operation of REACH and CLP 2016*[i] where poor quality of data is seen as a significant weakness. The report also indicates that it is envisaged that the interface between REACH and CLP and other pieces of legislation should be optimised and making more use of the data generated for REACH and CLP to comply with other pieces of EU chemical legislation e.g. the Industrial Emissions Directive, the Chemical Agents Directive and waste legislation. In the evaluation of dossiers and substances, ECHA and the Member States have identified several new and scientifically challenging issues such as new test methods, assessment of read-across and other alternative methods, proper identification and assessment of substances of unknown or variable composition (UVCB substances), characterisation and safety assessment of nanomaterials and the assessment of complex toxicological modes of action such as endocrine disruption.

Nanomaterials continue to present challenges for regulators where the practical application of an acceptable definition continues to be discussed. The EU Commission originally made a recommendation for a definition of a nanomaterial in 2011 in support of the REACH Regulation and this recommendation was subject to review in 2014 to clarify this definition and to address technical questions and still to be concluded. The application of a definition for a nanomaterial that can be measured is not only important to the functioning of the REACH Regulation but for other legislation such as the Novel Foods Regulation and Cosmetic Products Regulation which set technical specifications for permitted nanomaterials. Therefore activities concerning the measurement of nanoparticles will continue to be important activity under the Government Chemist Advisory Function.

It is envisaged that more REACH restrictions for substances in articles will be made setting predominately hazard based limit values. Although some efforts have been made by ECHA to identify validated methods in a *Compendium of Analytical Methods Recommended by the Forum to Check Compliance with Annex XVII Restrictions*[ii], but there are many gaps where methods are

required to measure ever lower toxicologically derived limit values. This presents an opportunity to develop analytical methodology to address these restrictions which would be of wider benefit.

The Water Framework Directive (WFD) continues to be an area where input or, at the least, oversight is necessary going forward. The number of potential priority substances identified for potential control under the WFD continues to grow leading to significant analytical challenges to be able to monitor an increasing range of pollutants and increasingly lower concentrations.

The approach to validation of 'historical' data derived from various sources and its place alongside current data has been raised as a concern during the stakeholder consultation process, where policy makers are reliant on use of such information for robust development of new legislation. It is proposed that a small desktop study be carried out to outline possible solutions to deriving best practice for consideration of such datasets.

Given the wide area of interest of the Advisory function across many technical sectors in Government departments and agencies (including devolved administrations) it could be more appropriate for the Government Chemist, or his representative(s), to better promote the importance of analytical measurement in support of regulation across different sectors through, for example, presentations at third-party seminars and conferences.

The number of consultations (UK Government and EU) to which the Government Chemist has responded has steadily increased. There does appear to be, particularly in the EU, a tendency to draft legislation without considered reflection on the measurements which are necessary as part of the monitoring or enforcement processes. The Government Chemist has a definite role in highlighting the need for high quality, fit-for-purpose measurements in support of legislation and regulation. Work to address these topics and provide stakeholder value is carried out as micro-funded studies. However, to maximise stakeholder value, these studies should be big enough to provide critical mass to the project area, so that a smaller number of somewhat bigger studies will be able to cover these important topics in greater depth.

Annex1-3 Stakeholder consultation

Overview

Figure 5 Stakeholder consultation process

Three independent brainstorming activities were carried out (as detailed in Figure 5) at which different stakeholders groups were asked to identify the requirements the Government Chemist Programme needs to plan for in the short term (the next 3 - 5 years) and long term (10 - 15 years).

The three groups comprised

(i) The GC PEG and LGC staff engaged in delivering the GC Programme (2 interactive sessions held)

(ii) Key stakeholders identified by the GC PEG (contacted via survey monkey)

(iii) The 120 delegates at the GC conference (at which an interactive session was held).

They were asked to take into consideration the following points;

1. What are the critical issues of safety and authenticity affecting the Food and Feed Sector, as they bear on the work of the Government Chemist considering?

   a. Developments in delivery food and feed regulation and models for enforcement will shape the environment in which the Government Chemist operates?

   b. Are there likely changes in the food and feed supply chains that the Government Chemist should take into account in planning for the future?

c. What are the advances in science, technology, data and societal changes that the Government Chemist should have regard to in planning for the future?
2. What are your current unmet 'measurement/method issues' (thinking about accuracy/reliability/comparability of measurement)?

Results

Legislation

Discussions around **short term** considerations for food and feed regulation and models for enforcement, within the remit the Government Chemist operates followed two themes: the need for regulation to reflect analytical capabilities properly taking into account statistical considerations. As sometimes the regulations are set based on the toxicological scientific evidence, but the analytical testing cannot achieve those limits. The second major point was that regulation must allow confidence for the consumer and the wider society and if there is no confidence then there will be more challenges of results which the government chemist will need to cope with. However it was thought that the GC was currently well placed to help drive the improvement in analytical capabilities by increasing the size and scope of the available "toolbox" for both analysts and "lay users" of testing methods. Although the stakeholder consultation was carried out prior to the Brexit vote, comments were made that if the UK leaves the EU, this could change both the financing and direction of the GC. Financial in terms of less resource means more would be pushed to manufacturers and retailers who would use a diverse range of labs with a wide range of approaches. This is likely to result in a less harmonized approach.

Discussion around **long term** requirements highlighted the potential effects of advances in biological sciences, in that the list of chemicals used within the food and farming sector will get shorter however the list of biologics is growing, in that synthetic biology offers the possibility of new pesticide routes in terms of gene suppression and RNA inhibition, however regulation is not advanced in this area. The other predicted trend was that the consumer could become the analyst being able to carry out composition & allergen (most obvious) analysis using hand held devices (such as Tellspec) that appear to offer the consumer the opportunity to check allergen and nutrition declarations on pack. This could results in them contacting trading standards or resulting in samples coming from the consumer directly.

Supply Chain

Factors that were thought to affect the supply chain in the **short term** were advances in technology, such as precision agriculture i.e. the use of satellite information, sensors, drones resulting in pesticides only applied where required, this could result in fewer pesticide cases and

sampling will be key to overcome generated homogeneity issues. Climate change resulting in a different set of contaminates related to floods, fires and recycling process. New ingredients, supplements and functional foods generating challenges regarding does the food contain what it is claimed to contain and also are there new contaminants we need to be aware of such as, algae food supplements possibly containing cyano-bacteria. There are also difficulties around does the functional food have the desired effect e.g. obesity control ingredients that might be regulated as novel foods or under health claims legislation for which FSA and the Department of Health have responsibility respectively. Traceability in the supply chain is still a point at issue with authenticity & geographical origin still a requirement to ensure the consumer confidence in terms of product description. However without high quality well curated open access databases, this will be difficult to attain. Also still seen as a priority is the improvement in the quality and global consistency of food allergen detection from the food manufacturing environment through the supply chain to high end laboratories.

Long term we may see precision agriculture develop further with artificial intelligence becoming prevalent, in addition alternative food sources are predicted to becoming more common such as insects and artificial meat. We may also see the introduction of intelligent and even possibly edible packing.

Science and Technology

In the **short term** it is expected that there will be increased use of non-targeted methods, for rapid screening and potentially as point of use analysis, for official controls e.g. portable XRF. This raises questions on how will this change enforcement activity, how will these devices be calibrated accurately and be accredited, especially as they will only focus on a target group of analytes, what could be missed- unknown unknowns. These technologies will only be as good as databases that back them up and require assurances of the validity of the data within them.

Molecular Biology approaches continue to advance and the GC needs to maintain state of the art capability here in order to take advantage of these, and its many potential uses. The falling cost of next generation sequencing can be applied to individual samples to establish species or to bacterial communities for product authentication in the case of probiotics and for determining geographical origin. In the **longer term** this will also be a requirement to be able to deal with the rapid advancement of synthetic biology and potentially cloning. Longer term it is also perceived that omics and fingerprinting approaches are will become more common place and should also therefore be taken into consideration.

Specific current unmet measurement requirements included:

1. Methods for different Allergens
2. Country of origin database with open access
3. Right to challenge results based on a single result chemo metrics used for interpretation.
4. Gaining independent assessment of results
5. Method availability for novel foods starting to be seen e.g. Algae food supplements-cyano bacteria
6. Reliability of vitamin D & B12 methods for food and feed, including sampling
7. Characterisation of relevant markers for authenticity
8. Inorganic As in food (e.g. algae, rice)
9. Gutter oils
10. Sampling guidance.

From these sessions, ideas raised more than once were included in the table below and will form the basis of projects to be developed for the 2017-2020 GC Programme Capability Building projects and subsequently prioritised by the PEG in terms of which should be carried out first.

Specific Project Ideas	**Highlight as an area for consideration**			**Total**
	LGC	**GC PEG**	**GC Conference**	
Allergens	1		1	**2**
GMO	1	1		**2**
Microbial Supplements (DNA)	1	1		**2**
Geographical Origin (DNA)	1	1	1	**3**
Species bacteria profile (meat & Fish) (DNA)	1		1	**2**
Inorganic As in food	1		1	**2**
New foods and novel ingredients		1	1	**2**
Chemical composition of functional foods/supplements	1	1	1	**3**
Geographical Origin (isotope ratio)	1	1	1	**3**
Screening/point of use technologies	1	1	1	**3**
Sampling Guidelines	1	1	1	**3**
Chemo metrics/omics /non-targeted method	1		1	**2**
Increase in new food sources e.g. insects & algae		1	1	**2**

Discussion & Conclusions

The horizon scanning activity highlighted strongly three new themes that the Government Chemist Programme needs to prepare for its forthcoming activities; the advance in biologically engineered products, advances in measurement technology for screening and fingerprinting, and new functional foods/novel ingredients. Some areas which have previously been the topics for capability building in the current programmes that persist to cause measurement issues are product authenticity/geographical origin and allergens. Also present the ongoing requirement for advice and guidance on sampling.

Annex1- 4 Overall Conclusions

Novel and unexpected measurement challenges were the *raison d'être* for the Government Chemist in the 19th century. In the 21st century the Government Chemist is still required as a backstop against measurement or interpretational error and, as the past 3 years have demonstrated, the challenges can still be wide and varied. Particularly, this is true in the context of the inter-related, complex and shifting regulatory issues that form the backdrop to the formulation of the 2017-20 GC Programme and evolving Government Chemist strategy. Referee casework continues to be demand led, highly non-routine and generally high profile, and the landscape in which we operate continues to place unprecedented demands. The contributions of the GCPEG in focusing on key issues in medium and long term horizon scanning, the advanced scientific and organisational infrastructure of LGC, the talent of its people and the support of BEIS, auger well for exciting and productive times ahead as the Government Chemist function rises to the inevitable challenges facing itself.

APPENDIX 1 Legislation under which the Government Chemist Duties Operate

The duties of the Government Chemist as referee analyst are defined in or under:

Food Safety Act 1990

Food Safety (Sampling and Qualifications) Regulations 1990[1]

Food (Northern Ireland) Order 1989

Food Safety (Northern Ireland) Order 1991

Food Safety (Sampling and Qualifications) Regulations (Northern Ireland) 1991

Poultry Meat (Water Content) Regulations 1984

Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations 2007

Materials and Articles in Contact with Food (England) Regulations 2012

Materials and Articles in Contact with Food (Scotland) Regulations 2012

Materials and Articles in Contact with Food (Wales) Regulations 2012

Materials and Articles in Contact with Food (Northern Ireland) Regulations 2012

Agriculture Act 1970

Feed (Hygiene and Enforcement) Regulations 2005

Genetically Modified Animal Feed Regulations 2004

Human Medicines Regulations 2012

Farm and Garden Chemicals Act 1967

The Government Chemist is named and has other scientific responsibilities under:

Merchant Shipping Act 1995

Hydrocarbon Oil Duties Act 1979

Poisons Act 1972

Status & territorial extent of the Government Chemist are understood with reference to:

Freedom of Information Act 2000

Scotland Act 1998 (Cross-Border Public Authorities) (Specification) Order 1999

Administrative Provisions Act (Northern Ireland) 1928

Government Chemist Regulations (Northern Ireland) 1928

[1] Due to be superseded in 2013

APPENDIX 2 Key Stakeholders

The Table details Key Stakeholder Categories and Their Representative Bodies with tick ✔ indicating that a relationship exists between them and the Government Chemist programme / LGC. Un-ticked bodies are those with whom we aim to work with in the future.

Category	Representative Bodies
Primary Producers	National Farmers Union and associated bodies in Scotland, Wales and Northern Ireland ✔ Salmon and Trout Association Scottish Salmon Growers Association Seafish Industry Authority ✔ Shellfish Association of Great Britain Agriculture and Horticulture Development Board ✔
Manufacturers	Food and Drink Federation ✔ Northern Ireland Food & Drink British Meat Processors Association ✔ British Soft Drinks Association Ltd ✔ Dairy Industry Association UK Association of Frozen Food Producers Premier Analytical Services ✔
Retailers	British Retail Consortium ✔ Institute of Grocery Distribution Wine & Spirit Trade Association Association of Convenience Stores Independent Food Retailers Conf. National Association of Health Stores British Hospitality Association ✔ Food and Drink Federation ✔
Food Supplements Trade	Council for Responsible Nutrition ✔ Health Food Manufacturers Association ✔
Importers	British International Freight Association British Association of Canned and Preserved Food Importers British Food Importers and Distributors Association
Professional Bodies	Royal Society of Chemistry ✔ Institute of Food Science & Technology ✔ Association of Public Analysts ✔ ITSA Chartered Institute for Environmental Health (CIEH) ✔ Association of Public Analysts in Scotland ✔
Feed, Feed Additives and Fertiliser Trade	Agricultural Industries Confederation ✔ British Association of Feed Supplement and Additive Manufacturers ✔ EU Association of Specialty Feed Ingredients and their Mixtures (FEFANA) ✔
Pet Food Manufacturers	Pet Food Manufacturers Association
Trade Journals	Food Manufacture ✔ Various - via LGC media centre
Trade Associations	Campden BRI ✔ Leatherhead Food Research ✔
Regulators	DEFRA ✔

	Food Standards Agency ✔ Department of Health ✔ Veterinary Medicine Directorate ✔ European Commission ✔ European Food Safety Authority Hong Kong
Enforcement	Local Government Authority (LGA) ✔ HMRC Association of Public Analysts ✔ Association of Port Health Authorities ✔ Medicines & Healthcare Products Regulatory Agency (MHRA) ✔
The Media	Science Media Centre ✔ Various - via LGC media centre
Consumer Bodies	Which ✔ Scottish Consumer Council Welsh Consumer Council Consumer Council Northern Ireland National Federation of Women's Institutes
Others	Federation of Small Businesses Food Law Group ✔ European Food Law Association Royal Inst of Public Health & Hygiene Sustain National Reference Laboratories ✔ European Reference Laboratories ✔ National Measurement Institutes ✔
Research Bodies	Most are covered by the GCPEG, additionally AFBI which also serves a referee analyst function Agrifood Biosciences Institute (Northern Ireland)
Charities	Anaphylaxis Campaign ✔ Allergy UK ✔ Allergy Action Coeliac Society
Universities	Kingston University ✔ University of Sussex ✔ University of Glasgow ✔ University of Manchester ✔ Royal Holloway (University of London ✔) London Metropolitan University ✔ Queen's University Belfast (QUB)- Institute of Global Food Security and School of Chemistry & Chemical Engineering ✔ University of Surrey ✔

The groups of stakeholders also represented in Figure 6 below:

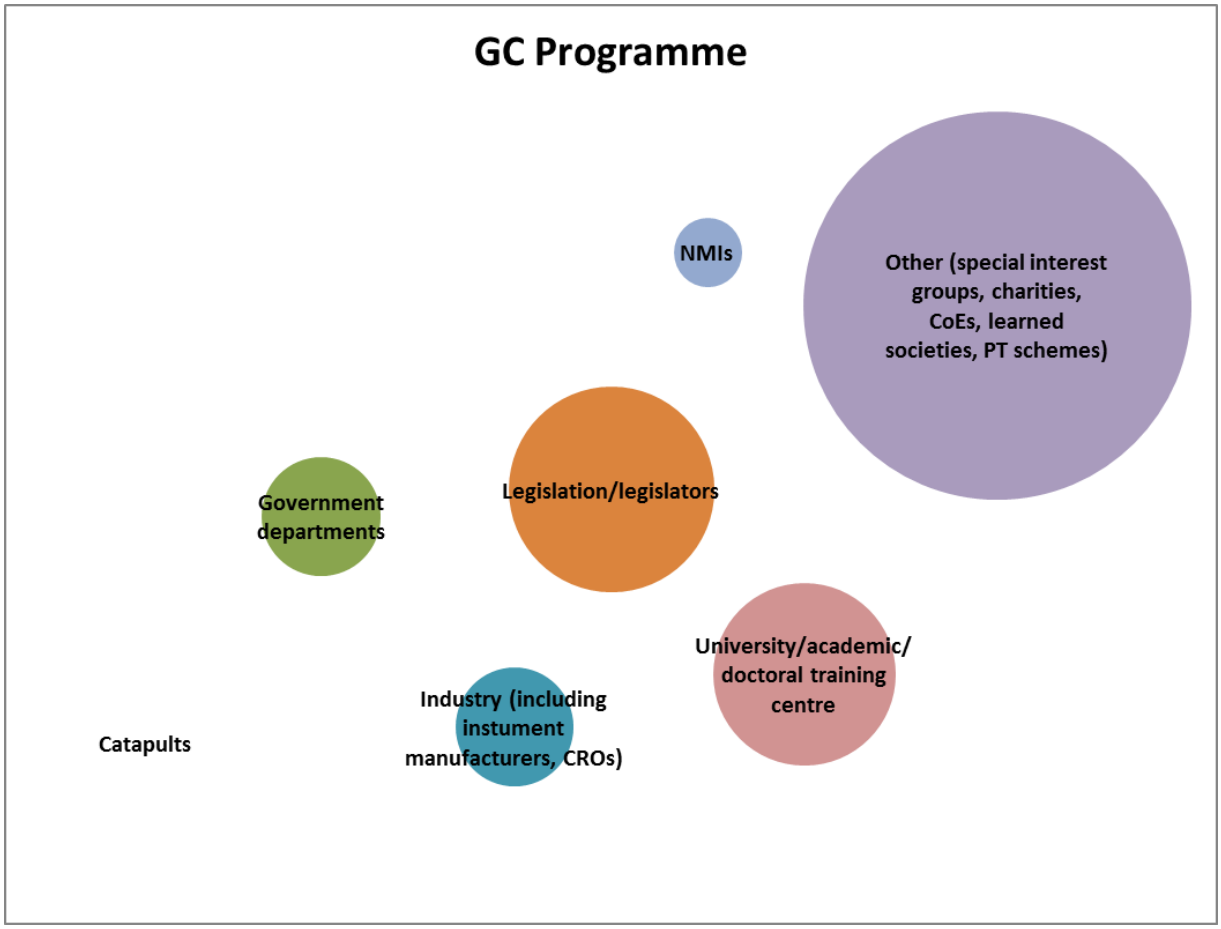

Figure 6 Bubble Plot showing the different stakeholders for which a direct relationship exists with the GC programme (Total 55)

[i] https://echa.europa.eu/documents/10162/13634/operation_reach_clp_2016_en.pdf
[ii] https://echa.europa.eu/documents/10162/13577/compendium_of_analytical_methods_en.pdf