

Specification for a Public Analyst Service as a National Resource for the Analysis of Food and Animal Feed in England, Wales & Northern Ireland

Introduction

In discussions between the Association of Public Analysts and the Food Standards Agency it has been agreed that the present arrangements for provision of analytical and scientific support to the food enforcement system in England and Wales are such that the service is in decline and is no longer able to provide as effective a service as the consumer has a right to expect. This is largely as a result of reduced availability of resources and changes in local authority structures in recent years. The situation has reached criticality and immediate action is now necessary.

Because the position in Scotland is somewhat different from the remainder of the UK that region has been excluded from direct consideration in this paper, although all the principles enshrined in the development of the Specification are equally valid in Scotland.

The Objective

The objective of determining a Specification for a Public Analyst Service is to define the service that should be provided to afford effective protection for the consumer in an efficient and cost-effective manner, with a view to its implementation in as short a timescale as possible.

Rationale

This document presents a proposal for a Specification for the statutory functions of Public Analyst, Agricultural Analyst and the provision of Official Food Control Laboratories in respect of chemical science.

Consideration has not been given to microbiological examination at this stage, although there would be obvious parallels for the service of food examination, and benefits would derive if the delivery of analytical and examination services were to be unified, as is largely the situation at present in Scotland.

This proposal is based on an assessment of what is appropriate and necessary for an effective service for the protection of the public (which also has the benefit of providing some degree of protection for the honest and diligent trader). In order to facilitate the next stage of assessing how to 'get there', comparisons with the present Public Analyst service are made throughout the paper.

The existence of the service derives from a fundamental need to protect consumers, and in developing the Specification "need" has been considered to be the consumer's need, rather than that perceived by individual local authorities or their officers, or what is dictated to them by dwindling budgets. There must be a program to define the nature and extent of the UK's enforcement science needs. Once in place, the system must be protected from ad hoc cuts by local authorities. It is a fact that many local authorities are under great financial strain. It is also a fact that many do not see food enforcement as a priority service, and this is why the Public Analyst Service is in its present neglected state.

This paper deals with matters related to food and animal feed only, and does not address the active and necessary rôle currently performed by many Public Analyst laboratories in other fields (water quality, consumer safety, occupational hygiene, environmental science etc.) for which there will remain a need for a service. Provision of services in these other areas is symbiotic, providing benefit to both food and non-food aspects.

Requirements – the Specification

The requirements for a Public Analyst service are addressed, with discussion, in the tables that follow on pages 3-14 of this paper, under the following headings:

- Core Functions
- Techniques and Equipment Needed
- Quality Matters
- Funding
- Working Arrangements
- Staff and Establishment Resources

Present Position

A third column in the tables on pages 3-14 does not form part of the Specification, but compares the situation as it currently exists against the Specification to facilitate consideration of changes needed.

Reference should also be made to the *Turner Report* on the Review of Public Analyst Arrangements in England and Wales which in 1998 reported on the service in detail, and which is still pertinent although there has been further decline since it was written.

Achievement of the Objective

The next stage in the process is for the Food Standards Agency, together with relevant stakeholders, to consider this proposal and formally to agree a Specification. It is suggested that relevant stakeholders must include consumer organisations.

Alongside agreement of the Specification must be agreement of the extent of sampling, and of Public Analyst participation in inspection, that are appropriate and proper for protection of the consumer. These are needed to determine quantitative aspects of the Specification.

Once these requirements have been agreed, it will be necessary to determine what practical model in terms of numbers/sizes/locations/funding of laboratories will best allow the Specification to be met. Following this, the steps necessary to make the transition from the present system can be determined.

If possible the consultation and decision-making process needs to be completed, required changes identified and detailed plans published within six months. Meanwhile, and certainly if there is any possibility whatsoever that the six month target might not be achieved, it is critical that positive action be taken as a matter of urgency to ensure that the decline in the Public Analyst service is reversed during the coming financial year before any further laboratory and staff resources are lost from the system.

The Association of Public Analysts
March 2002

Tables of Requirements – the Specification

<u>A) Core Functions</u>	<u>Comment</u>	<u>Present Position</u>
1. Analysis of food and animal feed.	- The extent/depth of analysis, and the numbers of samples analysed, need to be sufficient to ensure an acceptable degree of protection for the public.	- All Public Analyst laboratories undertake food analysis at present, and with the exception of some laboratories serving only urban areas they also analyse animal feed. The extent/depth of analysis varies between laboratories and more so between authorities as a result of availability of resources.
2. Interpretation of analytical data in light of legislation or reasoned opinion.	- Analytical results on their own give little meaningful information.	- All Public Analysts undertake this at present. It is a fundamental requirement that must be recognised in any tendering exercise.
3. Expert opinion & witness.	- To assist and support formal action including.	- All Public Analysts undertake this at present.
4. On site inspection of food processes, records, ingredients, formulations etc.	- Public Analyst input is of particular benefit in scrutinising scientific aspects, including analytical records, in assessing product against raw materials, and in assessing materials that should be sampled. In addition, access to the production process assists Public Analysts to perform functions 1-3 better.	- All Public Analysts are prepared to bring their scientific expertise to assist with this, but at present very few authorities avail themselves of this facility. This work can require substantial human resources at a senior level, particularly in areas where there are many larger food premises.
5. Provision of scientific advice & support to other arms of the enforcement service.		- All Public Analysts offer this at present, although the extent to which use is made varies considerably.
6. Undertake analytical method development.	- There is also sense in some aspects of method development being undertaken by other organisations such as CSL, LGC or under contract in Universities etc., particularly in respect of new techniques, or where primary research is required.	- All Public Analyst laboratories do this at present to some extent, although with only limited co-ordination between them, which can risk duplication of effort. Co-ordination cannot be assisted by perceived need for laboratories to try to achieve “commercial advantage” over others.

Tables of Requirements – the Specification

<u>A) Core Functions</u>	<u>Comment</u>	<u>Present Position</u>
7. Maintenance and support of all necessary expertise and specialisms within the overall service.	- There needs to be a mechanism to ensure that specialist techniques and expertise are effectively organised and co-ordinated.	- At present there are insufficient resources to support or develop all necessary specialisms.
8. Independent and transparent.	- There must be no risk of influence in terms of analytical capability, results or interpretation arising from any commercial, political or other pressure.	- All Public Analysts recognise the need for this.
9. Consumer champion.		- Protecting the consumer has been the <i>raison d'être</i> for Public Analysts for 130 years
10. Interface with FSA.	- To advise on enforcement issues, receive intelligence on food issues and plan method development. This should include provision for funding of representation at FSA advisory groups.	- Mechanisms for information exchange are evolving, though there is scope for further development. Current costs of representation are partly borne by the laboratories employing the Public Analysts involved, and partly by the APA – the latter deriving from the personal subscriptions of members.
11. Liaison & co-ordination with LACOTS & local groups, plus other scientific and technical liaison and standardisation bodies such as BSI, ISO etc.	- To provide scientific input and advice, to maximise co-ordination and co-operation, and to improve analytical methodology.	- Although this is largely unresourced and relies upon the goodwill and personal commitment of individuals, it does happen at present.
12. Evaluation of current and draft legislation.	- It is important that Public Analysts evaluate and comment on legislation, particularly (but not wholly) from the point of view of enforcement science.	- Current funding mechanisms do not provide for the necessary input.

Tables of Requirements – the Specification

A) Core Functions

Comment

Present Position

13. Contribute to a national database of food information.

- A comprehensive national database of food should be established. This would be invaluable as a support to the sampling process, showing any food categories or analytical parameters that have not been adequately covered, and enabling ready identification of problem areas.

A national database would also be a valuable tool to assist Public Analysts with interpretation where normal levels or trends may be of relevance.

For validity the analytical data must be confined to adequately verified information from scientifically independent sources using comparable analytical methods (i.e. only from Official Food Control Laboratories).

- There is currently no national picture of food, its sampling or data derived from its analysis, and no mechanism for release of that information by either local authorities or their Public Analysts.

Public Analysts do pool information to assist in the interpretation of analytical data whenever an identifiable issue arises, but the absence of an integrated system means that it is a relatively laborious task, so it is not a routine process and is confined to major issues.

Tables of Requirements – the Specification

B) Techniques and Equipment Needed

(See glossary at end of paper for more information)

The service must have available to it all techniques necessary for food law enforcement, although not all necessarily need to be within a Public Analyst laboratory. As a matter of policy, a technique needs to be directly in the enforcement system once its use exceeds a threshold (to be defined).

At present the following techniques are clearly required within the service, being the minimum range of techniques that must be directly available, although not all of these need to be in every individual laboratory provided that there is ready accessibility somewhere in the Public Analyst service whenever required.

- ⇒ Classical wet chemistry
- ⇒ GC including GCMS & high resolution GCMS
- ⇒ HPLC, LCMSMS
- ⇒ AA and/or ICP
- ⇒ Electrophoresis techniques
- ⇒ Immunoassay techniques
- ⇒ DNA techniques
- ⇒ Microscopy
- ⇒ IR
- ⇒ Cryoscopy
- ⇒ Extraction techniques (SCF etc)
- ⇒ Rapid nitrogen analyser
- ⇒ Radioisotope monitoring
- ⇒ PPSL
- ⇒ UV/visible spectroscopy
- ⇒ Unified LIMS systems inc database links
- ⇒ Effective information systems including with access to relevant journals etc.

Comment

The threshold that determines whether a technique must be available from within the service needs to take into account likely sample throughput (number and frequency) and any legislative requirement for a particular analysis.

This is a dynamic scenario, with techniques that initially are regarded as exotic research tools at some point passing into routine use, therefore these lists of required techniques must be kept under constant review.

Techniques the need for which at present may fall below the threshold requiring their direct availability in the Public Analyst service currently include SNIF-NMR, XRF, SEM, TL and ESR. It is important, however, that the accessibility and availability of any technique necessary for food law enforcement but not available within the Public Analyst service must be assured.

It is noted that there are issues with respect to accreditation and to appropriate direction of the analysis that need to be satisfied for all techniques outwith Public Analyst laboratories.

Quantification of resource needs is linked to analytical need. The Risk Based Sampling scheme will be part of the process of determining this.

Present Position

Equipment levels vary between laboratories (but not necessarily in relation to laboratory size), however all existing Public Analyst laboratories are at least sufficiently equipped at present to meet the minimum scope currently prescribed in the UK for recognition as an Official Food Control Laboratory.

At present no Public Analyst laboratories have LCMSMS or high resolution GCMS, while some techniques are not sufficiently widely available (e.g. SCF extraction). Some of the more specialised techniques are patchy in their availability and extent of implementation at present, although all are present somewhere.

Tables of Requirements – the Specification

C) Quality Matters

- Official laboratories notified to the EC.
- Accredited
- Proficiency tested
- Validated methodology
- Analytical Quality Assurance (AQA) sufficient to satisfy the burden of proof required by criminal law.
- Statutory Mastership in Chemical Analysis (M.Chem.A.) qualification to accredit the person charged with giving interpretations and opinions.
- Continuing professional development and competence.

Comment

Basic requirements for laboratories in terms of laboratory accreditation, proficiency testing and analytical methodology are described in the EC Directive on Additional Measures for the Control of Foodstuffs, implemented in the UK by a memorandum of understanding between MAFF, DoH and UKAS drawn up in 1999 and published as UKAS document NIS42.

Neither the Directive nor NIS42 give detail as to required AQA. Since 1986 when the APA published a protocol for a statistically derived system for AQA of analytical batches it has been applied by Public Analyst laboratories, but always supplemented by substantial additional checks on samples to be reported as unsatisfactory. A lesser system would not give adequate assurance of the quality of reported results.

Present Position

Existing Public Analyst laboratories meet the requirements for laboratories in respect of food, and have all been notified as Official Food Control Laboratories to the EC.. The APA expects that parallel requirements will be introduced in respect of animal feed, but there would clearly be resource implications.

The comment alongside reflects the importance of quality of analysis recognised by all Public Analysts

All Public Analysts hold the statutory M.Chem.A. qualification, and the APA has recently introduced a Continuing Professional Development (CPD) scheme to guide and assist Public Analysts in formally recording their achievement in this area.

D) Funding

- Must be adequate for the provision of the defined service.
- Must be nationally defined and monitored.
- Must be stable in short and long term.
- Must not be an impediment to the passing on of samples.

Comment

A minimum spend per consumer for the chemical analysis of food should be identified. It is believed that there may be precedents for such targets in other areas (Health? Education? Policing?). It would be reasonable to expect in return a performance indicator from the laboratory (e.g. an annual report, with statistics) in order to monitor value for money.

Present Position

Present funding arrangements do not meet these requirements.

The mechanism for funding needs to be revised in order to ensure that the requirements for funding are met.

Tables of Requirements – the Specification

<u>E) Working Arrangements</u>	<u>Comment</u>	<u>Present Position</u>
1. Certainty and stability of funding, adequate to support the agreed level of service.	- The service should be recognised as a key national resource, and treated as such. Whilst it must represent “Best Value” the process for assessment needs to be clear. Ideally it should be designed into the service.	- Certainty and stability of funding are patently not the case at present. Furthermore, the mis-application of “Best Value”, interpreted simply as the cheapest service, runs counter to this, while also wrecking the partnership and cooperation essential for an effective service.
2. Efficient and cost-effective performance that meets enforcement needs, including such matters as sample ‘turnaround’ time, reliability of results, quality of advice, input to planning of sampling programs and provision of training.	- Benchmarking should be used to ensure that the service has demonstrably effective performance. Sensibly this should be between individual laboratories in the service, and with equivalent laboratories elsewhere in the EU. Service level agreements based on a national model emphasising a partnership philosophy should exist to govern sampling effort by local authorities, delivery of results by laboratories etc.	- Current laboratory performance can be quite varied but is largely related to available resources. Some limited benchmarking does take place at present, though it is not comprehensive and does not include all laboratories.
3. Agreed specialisms in laboratories, with “passing on” provisions to cover sample overload as well as defined specialist areas of work.	- Some techniques are of such a specialist nature that only one ‘centre of excellence’ may be justified. Demand for other techniques may be insufficient to justify facilities in every individual laboratory. The whole system must act as an integrated whole with no impediment to sample movement.	- At present some specialisms do exist, though they have arisen in a haphazard and unplanned manner, while numbers of important techniques are missing. ‘Passing on’ is seriously inhibited by the current approach to resourcing.
4. Provision for staff secondments to other laboratories within the Public Analyst field and LGC & CSL.	- This is to maximise both the training facilities for staff and flexibility of service, including emergencies.	- Does not happen at present.

Tables of Requirements – the Specification

<u>E) Working Arrangements</u>	<u>Comment</u>	<u>Present Position</u>
5. Co-operation between laboratories, not competition	<p>- The reasons for this are that for an efficient and effective UK service, and for all other parts of this Specification to work, it is critical that there be a free flow of information and support between laboratories, including method information, assistance with interpretation, maintenance and use of specialist techniques, passing on of samples, staff secondment etc.</p> <p>Laboratories need to provide a competitive service but not be in competition with one another.</p>	<p>- There has been a trend to subject laboratories to competitive tendering, which combined with underfunding challenges the ability of laboratories to comply with this need.</p> <p>In addition, some “Best Value” auditors see Public Analyst laboratories as simply providers of cut-price analytical data, not partners in the enforcement process, and make recommendations that are insensitive to the needs of the service, damage relationships, and which may ultimately prevent true Best Value from being achievable.</p>
6. Recognition and budgetary provision for training of staff and CPD		<p>- The organisation and delivery of training for future Public Analysts and CPD of existing Public Analysts currently relies largely on the charity of members of the APA and on the unpaid donation of personal time by numbers of existing Public Analysts.</p> <p>Support for training events from laboratories (in terms of both time and resources) has dwindled in recent years.</p>
7. Effective communication between all Public Analysts, other laboratories involved in enforcement or research (LGC and CSL), and FSA scientists, with defined rôles for each of these complementary scientific interests.	<p>- Formal arrangements should be established to ensure this.</p>	<p>- At present there is too little communication, with inadequately defined rôles, which can result in duplication of work, inefficient conveyance of information about new issues, and professional jealousy.</p>

Tables of Requirements – the Specification

<u>F) Staff and Establishment Resources</u>	<u>Comment</u>	<u>Present Position</u>
1. Number of Public Analysts:		
<p>The statutory Mastership in Chemical Analysis (M.Chem.A.) qualification for appointment as a Public Analyst accredits the individual who makes the decision as to whether or not samples are satisfactory.</p>	<p>The minimum required number of Public Analysts is related to the number of samples and other work to be done – which is a fundamental question that remains to be answered.</p>	<p>At present the profession is so small as not to be able to sustain training courses, attend to all the professional committee work, or attract enough entrants to the career. There are currently only about 55 practising Public Analysts, compared to about 70 at the beginning of 1998.</p>
<p>The Food Safety Act requires work to be done under the direction of a Public Analyst, and reported by him/her. The Agriculture Act imposes similar requirements in respect of animal feed.</p>	<p>Sampling obviously must not be set falsely high just to sustain the profession, but the Association's belief is that if sampling activity is set high enough to give adequate consumer protection, then the rest will follow.</p>	<p>Given the already small number of Public Analysts, the reference to retention of expertise and experience made in the discussion of this item is critical.</p>
<p>There must be sufficient Public Analysts to undertake all that is required of them.</p>	<p>In any change to the Public Analyst Service no further expertise or experience should be lost from the system. Furthermore, in the interests of efficiency the existing expertise of other staff in Public Analyst laboratories should be incorporated in any change to the system.</p>	
<p>The number also has to be enough for the profession to be self-sustaining.</p>		

Tables of Requirements – the Specification

<u>F) Staff and Establishment Resources</u>	<u>Comment</u>	<u>Present Position</u>
<p>2. Number of laboratories:</p> <p>A local scientific service is needed to support local authorities' inspection and enforcement rôle. However, laboratory overheads (premises, quality assurance, safety aspects) are high. Expensive capital equipment needs to be used to the maximum. These factors mitigate against a large number of laboratories.</p> <p>One practical solution would be a network of laboratories, each with one or more specialisms, with all laboratories capable of doing the basic work.</p> <p>No precise quantification of the ideal number or size of laboratories forming the network can be done until the level of sampling and inspection activity has been defined.</p>	<p>For a service based on a network of laboratories to be efficient and effective, establishment of the network will require strategic planning.</p> <p>With a network as described all laboratories would have the same core of routine (“general practitioner” or “GP”) capability, supplemented by various specialisms that would be used by numbers of other laboratories ‘passing on’ samples, or to provide advice and assistance with a routine application in the same field.</p> <p>Whatever the laboratory arrangement, facilities for funding will require careful consideration to ensure that the system works and laboratories are able to perform the tasks expected of them, and thus assure the effectiveness of the whole system.</p> <p>There is no theoretical impediment to laboratories being in either public or private ownership, or owned by some form of public-private partnership, provided that all aspects of this Specification are incorporated.</p>	<p>There are 25 laboratories spread throughout England, Wales and Northern Ireland, of varying sizes, in locations that are not necessarily related to either demographics or geography.</p> <p>The current laboratories are under several different types of ownership, some with many specialisms, others with few (though laboratory size and the availability of specialisms are not necessarily related).</p> <p>Some laboratories work together to some extent, while others are in direct competition.</p>

Tables of Requirements – the Specification

F) Staff and Establishment Resources

Comment

Present Position

3. “GP” Requirements – for all laboratories:

It is envisaged that all laboratories need to be capable of handling “everyday” food analysis, and feeding stuff analysis if serving an applicable area, and must therefore be equipped and staffed at least to do the following:

- Common toxic metals
- Proximate analysis
- Labelling verification (other than health claims)
- Preservatives
- Colours
- Sweeteners
- Alcohol
- Speciation
- Consumer complaints
- Microscopy

The differentiation between “general practitioner” techniques and specialist techniques is based on a number of factors, particularly:

- a) Where very expensive equipment is needed, but the overall volume of work nationwide does not justify widespread availability, and/or
- b) Where the maintenance of expertise required to apply a particular technique requires a high rate of continuing use, but the volume of work does not support widespread availability, and/or
- c) Where there are specialist or expensive requirements in terms of accreditation or proficiency testing that can only be supported by a throughput of samples not available on a widespread basis.

The defined scope of “GP” work is within the capability of all existing laboratories.

Tables of Requirements – the Specification

F) Staff and Establishment Resources

Comment

Present Position

4. Specialist Requirements:

These include:

- Pesticide residues
- DNA techniques inc GM analysis
- Taints
- Less common elements at trace level
- Vitamins
- PCBs, dioxins
- Veterinary residues
- Food contact materials
- Irradiated food
- Bottled water analysis
- Novel foods, health claims etc
- Monitoring of food for radio isotopes (Chernobyl capability)

The specialist requirements could be the province of one or more dedicated laboratories.

They could instead be distributed between all laboratories, such that each has at least one specialism in addition to covering all required “GP” work. This latter approach would have the advantage of maximising professional interest throughout the network of laboratories, and is therefore to be preferred.

In some cases basic work on a particular topic may count as “GP”, with more detailed work (e.g. perhaps using more sensitive instruments) amounting to a specialism.

At present some of the required specialisms are only partially covered within Public Analyst laboratories, while for others capability is extremely limited or absent. This is mainly a consequence of direct expense for some techniques, or insufficient sample throughput to enable expertise to be maintained in the absence of supporting resources for others. Availability of the specialisms that do exist is unsystematic when the country is viewed as a whole.

Tables of Requirements – the Specification

F) Staff and Establishment Resources

Comment

Present Position

5. Method development and validation:

This should be allocated to laboratories having relevant expertise and equipment. Funding would need to be made available for this national contribution, and once finished, the method made available for all that need to use it within the enforcement system.

This work need not necessarily be done in Public Analyst laboratories, although where it is not it must be undertaken with close liaison with Public Analysts to ensure that it meets the needs of enforcement analysis. There needs to be a co-ordination process to ensure that this is done in the most appropriate laboratory in order to maximise efficiency.

Method development in Public Analyst laboratories at present tends to be reactive rather than proactive. Nationwide it is largely unplanned and most significantly is largely unresourced, while information about developed methods is rarely transmitted to other laboratories.

Current development by other bodies can duplicate the work undertaken in Public Analyst laboratories, can show naivety with respect to the needs of enforcement laboratories, and sometimes resultant methods are jealously guarded for commercial reasons.

6. Training and Development of Staff

On-going training and development of staff at all levels is vital, and of potential future Public Analysts is crucial.

To attract and retain staff of an appropriately high calibre and to encourage them to undertake the intensive training and make the commitment necessary to gain the M.Chem.A. requires an attractive career structure, reasonable reward and a foreseeable future for the profession. Recognition of this is imperative, and is in addition to the need for direct commitment of resources for training.

At present laboratories do provide training for their staff, although often not to the degree that may be wished.

Attraction of high calibre staff and persuading them that a career as a Public Analyst is worth the commitment is not easy in the present circumstances.

Glossary of Techniques and their Uses

<u>Acronym</u>	<u>Technique</u>	<u>Use</u>
AA	Atomic Absorption Spectroscopy (To include automation.)	Toxic metals and essential elements/minerals, in extracts from food. Hydride generator required for low levels of certain metals, notably arsenic, mercury and selenium. Graphite furnace may also have use for the lowest levels of some metals, but not as widespread availability.
	Cryoscopy	Detection of water in milk.
	DNA techniques – mainly based on Polymerase Chain Reaction (PCR) techniques with electrophoresis.	Identification of species (plant or animal), detection of genetically modified food.
	Electrophoresis (particularly iso-electric focussing)	Identification of proteins and amino acids; fish species identification.
ESR	Electron-Spin Resonance Spectroscopy	Used for some foods for the detection of evidence of having been subjected to ionising radiation.
FTIR	Fourier-Transform Infrared Spectroscopy	A more sophisticated and sensitive development of IR
GC	Gas Chromatography (To include capillary and column instruments, with detectors to include flame ionisation, electron capture, nitrogen, phosphorus and possibly also katherometer, also to include headspace facility, and to include automation.)	Volatile organic substances, including contaminants, ingredients and their constituents. Also packaging gases.
GCMS	Gas Chromatography with Mass Spectrometer detector (to include automation)	As GC but with giving greater information to assist with identification or confirmation. The much more expensive high-resolution (and high sensitivity) variant increases the capability, and is needed for such trace contaminants as PCBs and dioxins.
HPLC	High Performance Liquid Chromatography (With detectors to include multi-wavelength or scanning UV/visible, fluorescence and pulsed amperometric, and with automated facility.)	Mainly for non-volatile organics in extracts from food, including ingredients (particularly additives), contaminants and vitamins. Different detectors have different sensitivity and specificity, general detectors such as UV/visible suffering from lack of specificity unless multi-wavelength information is used.
ICP	Inductively-Coupled Plasma Emission Spectroscopy (to include automation.)	Metals, both toxic and essential elements, in extracts from food. Basic instruments comparable to sophisticated AA systems of similar cost. More advanced instruments bring

Glossary of Techniques and their Uses

	(to include automation.)	greater analytical efficiency.
	Immunoassay – primarily Enzyme-Linked Immuno Sorbent Assay (ELISA)	Identification and quantification of proteins, commonly used for soya and casein determination but with much wider scope.
IR	Infrared Spectroscopy	For identification of certain organic substances – particularly useful for identification of types of plastic (e.g. found as foreign objects in food)
LCMSMS Also known as LC(MS) ²	HPLC with twin serial Mass Spectrometer detectors	A high resolution and high sensitivity (and high cost) variant of HPLC, particularly useful for trace non-volatile organic substances such as residues of veterinary drugs and hormones.
	Microscopy – optical microscopy	Determination of cellular matter, foreign objects, mould etc.
NMR	Nuclear Magnetic Resonance Spectroscopy: particularly Carbon-13 NMR and SNIF-(Site-specific Natural Isotope Fractionation)-NMR	Primarily used to detect adulteration of certain naturally-derived foods, e.g. fruit juices.
PPSL	Pulsed Photo-Stimulated Luminescence Spectroscopy	Used for some foods for the detection of evidence of having been subjected to ionising radiation.
SCF	Super-Critical Fluid extraction	An efficient means of extraction and concentration of trace organics from food (e.g. pesticides), also rapid fat analysis.
SEM	Scanning Electron Microscopy (To include electron microprobe)	Main use is in analysis of foreign objects in food, providing compositional data on fragments of glass, coatings of fragments of metal etc.
SNIF-NMR	See NMR	
TL	Thermoluminescence	Used for some foods for the detection of evidence of having been subjected to ionising radiation.
XRF	X-Ray Fluorescence	Identification of small fragments of metal (e.g. foreign objects in food)