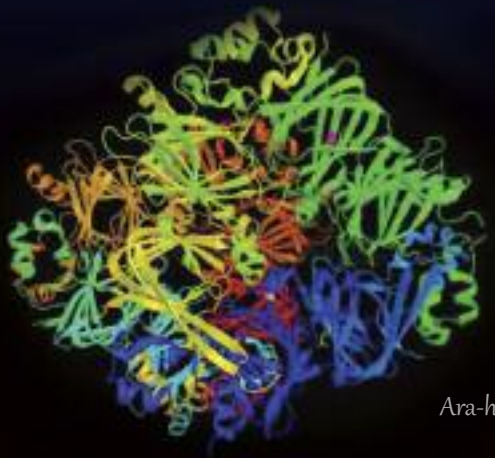
Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Western Region Public Analyst's Laboratory
Régiún an Iarthair Saotharlann an Anailisí Phoiblí

Annual Report 2015 and 2016
Tuarascáil Bhliantúil 2015 and 2016

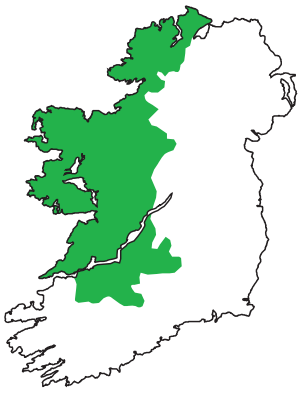


Ara-h1 Peanut Protein

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Western Region
Public Analyst's Laboratory
Régiún an Iarthair
Saotharlann an Anailisí Phoiblí

Annual Report 2015 & 2016
Tuarascáil bhliantúil 2015 & 2016



FOR YEARS ENDED 31ST DECEMBER, 2015 & 2016

CONTENTS ..... PAGE

ACKNOWLEDGEMENTS

I am pleased to present this report outlining the work performed in this laboratory during the years 2015 and 2016.

This is the first time that a biannual report has been issued by this laboratory. This was entirely due to the acute staffing difficulties incurred in 2016. These difficulties necessitated the setting aside of some, and the postponement of other activities, the compiling of the 2015 Annual Report being one of the latter.

The ongoing reduction in staff numbers negatively impacts the service being provided by this laboratory and severely erodes staff morale.

A total of four staff left during 2015/2016. Two of these positions (Senior Laboratory Technicians) were filled by internal candidates, which still left four unfilled posts. Two Laboratory Technician positions were approved for filling, candidates were selected by interview, but their appointments were suspended on foot of a nationwide embargo. One of these positions was filled this year.

On a more positive note, the laboratory received approval for the purchase of equipment from a National Capital budget in the sum of €360,000. This allowed for the replacement of equipment, some of which was 20 years old. This investment in replacement equipment is essential in order that we meet the demands of our customers.

I am very grateful to the HSE West, in particular to Grainne Cahill (Technical Services Merlin Park) and to Ger Flynn (National Clinical Head of Medical Devices) for their support in securing this funding.

Finally I would like to commend the hard work and dedication demonstrated by the laboratory staff during the year.

Rory Mannion
Public Analyst

September 2017

This report is also available on the HSE website (www.hse.ie) in both Irish and English.

1. INTRODUCTION

1.1 Public Analyst's Laboratory Service

This laboratory is one of three Public Analyst's Laboratories in the Republic of Ireland. The other two are located in Dublin and Cork. The primary role of the laboratories is in the protection of public health and consumer interests by providing an independent analytical and advisory service to the general public and various government agencies (EHS, SFAI, HPRA, Local Authorities, etc.) responsible for offical control of food, medicines, water, etc. Some testing and advisory services are also provided to the general public and other government agencies. The service areas provided by this laboratory are as follows.

Food
A food surveillance programme is agreed each year between the Public Analyst's Laboratories, the Food Safety Authority of Ireland (FSAI), and the Environmental Health Service (EHS). The samples are mainly submitted to the laboratory by the latter. Samples are also received from the general public, local industry and other government agencies.

Water
Most of the waters received by the laboratory are drinking waters for compliance testing with the Drinking Water Regulations. These are received from EHOs on behalf of Local Authorities, directly from Local Authorities, from the general public and from local industry. All Fluoridated water supplies are also tested for compliance with the Fluoridation Regulations.

The laboratory also tests the water used in hospital Dialysis units in the western region of the country.

Pharmaceuticals
Pharmaceutical samples are received from the Health Products Regulatory Authority (HPRA), formerly the Irish Medicines Board (IMB) on foot of a contract between the laboratory and the HPRA. A service is also provided to the Pharmaceutical Society of Ireland.

Toxicology
Hospital Pathologists and Physicians as well as Veterinary Surgeons and the general public submit samples for toxicological analysis.

Air Monitoring
An air pollution monitoring service is provided by the laboratory to Galway City Council.

Cosmetics
Samples of cosmetics are received from EHS as part of an agreed surveillance program. Complaint samples are also received.

1.2 Finance

The laboratory receives a budget to cover both pay and non-pay costs for the year. The budget received for the year 2015 was 2.376 million euro. The income received for the year was 226,873 euro.

The budget received for the year 2016 was 2.365 million euro. The income received for that year was 242,962 euro. The laboratory operated within budget in 2015 and 2016.

The laboratory is grateful to benefit from an additional capital allocation for the replacement of some essential laboratory equipment in 2016.

1.3 Administration

The laboratory is administered by the Primary, Community and Continuing Care (PCCC) Directorate within the Health Service Executive.

1.4 Workload

The number of samples received during the years 2015 and 2016 is as follows:

Samples Received	2015	2016
Foods	2,924	1,602
Waters	6,932	7,589
Pharmaceuticals	178	153
Toxicology	202	250
Cosmetics	249	165
Air-Monitoring	839	911
Miscellaneous	23	4
Total	**11,347**	**10,674**

2. FOOD SERVICE

2.1 Service Provided

Food is monitored nationally for chemical safety and legislative compliance. The Environmental Health Service (EHS) of the HSE, and the Food Safety Authority of Ireland (FSAI, www.fsai.ie) are our main clients, see Table 2.1. The service provided includes programmed surveillance and also some ad-hoc testing (food complaints and alerts, 'inspection' samples etc.) as required. The authorised officers and FSAI, as appropriate, have the responsibility for dealing with the incidents of detected non-compliances referred-to in this report.

Occasional applied research projects are carried out in conjunction with safefood, www.safefood.eu

**see Reports of the Food Microbiology Laboratory, UHG for a summary of the results of Microbiological testing of foods in HSE West area.*

2.2 HSE Food Safety Laboratory Service – Updates/Developments etc.

2.2.1 General/Review FSLS

A Food Safety Laboratory Service (FSLS) is provided by the HSE's seven Official Food Microbiology Laboratories (OFMLs) and three Public Analysts' Laboratories (PALs). Back in July 2004 a report entitled "A Strategic Developmental Review of Health Board Food Control Laboratories (safefood 2004)" was published;
http://www.safefood.eu/Publications/Research-reports/Strategic-Development-Review-of-Health-Board-Food.aspx.

The Report contains 16 recommendations including, inter alia, combining the Laboratories into a unified, multi-sited Food Safety Laboratory Service. The recommendations have yet to be officially implemented. The FSLS exists but without an official, national coordinating structure.

Table 2.1: Food Sample Sources 2015 & 2016

	2015		2016	
Submitted by / Sample Type	No. of Samples	No. on which Adverse Reports were issued	No. of Samples	No. on which Adverse Reports were issued
Environmental Health Officers				
Informal Routine (Sampling Programme)	1,126	150	886	103
Public (Food Complaints via EHOs)	122	49	85	48
Follow-up samples (non-programmed)	121	31	59	10
General Public				
Complaints	14	3	20	8
Others	915	4	222	8
Food Safety Authority of Ireland	532	0	147	0
Sea Fisheries Protection Agency & BIP	14	0	12	0
DAFM	11	0	36	0
Local Authority Veterinary Service	15	0	25	0
National Standards Authority of Ireland (Bottled Waters)	0	0	9	0
Laboratory QA & Method Development etc.	54	1	101	1
OVERALL TOTAL	**2,924**	**238**	**1,602**	**178**

2.2.2 Developments in National Public Analysts' Laboratory Food Service

Recent developments in the Public Analysts' Laboratory Food Service include:

• Development of National Testing Specialisations and a widened range of test parameters covering: Food Contact Materials, Meat Speciation, GMOs, Food Allergens, Plant Toxins, etc.
• Increased surveillance of certain foodstuffs' categories (Infant Formula etc, Bottled Waters, 'Salted' Foods (Na/K), Food Supplements, Food Contact Materials, etc.), as part of an enhanced, nationally coordinated food surveillance programme.
• Increased reporting requirements. Having decided to perform more analysis of data on official, EU food surveillance, the European Food Safety Authority (EFSA) now requires extensive, additional data on food test results, including performance characteristics (LOD, LOQ, UM, etc). FSAI, as national Competent Authority, collects the laboratory data for Ireland.
• Wider Client Base. Each of the three Public Analysts' Laboratories (PALs) now receive food samples on a national basis from a wider range of authorised officers (Veterinary Officers, Sea Fishery Protection Officers, FSAI, NSAI).
• Reporting Consistency: arising from the above points, the Public Analysts have agreed a National Reporting Consistency Document covering report format and structure, wording, legislative standards, assessment and designation of results, etc.
• It is now more commonplace to find that the food businesses will challenge official results from the laboratory, as they will now often have their own certificates of compliance.
• New Instrumentation obtained and accreditation of testing achieved and enhanced, including flexible scope.

2.3 Food Testing (Chemical) Results for 2015 and 2016

2.3.1 Regional Chemical Surveillance Programme 2015 & 2016

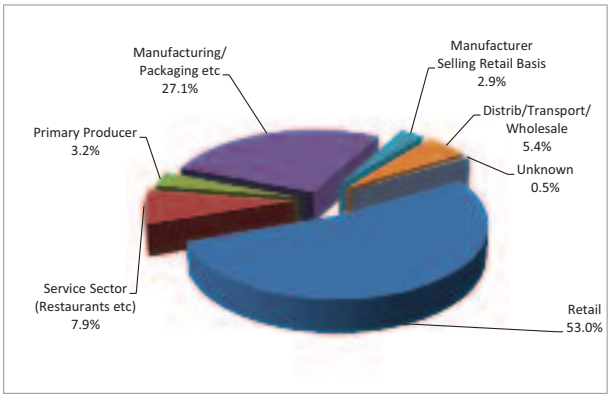
Nationally co-ordinated, Regional Food Surveillance (Chemical) Programmes are produced by the HSE (PALs and Environmental Health Service (EHS)), in association with the FSAI, drawing on risk-based priorities and sampling requirements identified by the group, chaired by FSAI. HSE West's Chemical Testing Programmes (components of HSE national programme) for 2015 and for 2016 are outlined in Appendix 1.

2.3.2 2015 & 2016 Samples

A total of 2,924 samples was received in 2015 while 1,602 samples were received in 2016. The decrease in sample numbers for 2016 is explained by the reduction in staff, by a discontinuation of private testing for gluten, and by a decrease in the number of Salt Reduction Programme samples from FSAI.

The Figures below indicate the 'stage' at which EHS samples (excluding food complaints) were taken in 2015 and 2016. There has been a significant decrease in retail-level sampling over the past few years and an increase in sampling from further back the food chain.

2015 Sampling Stages for EHS samples



2016 Sampling stages for EHS samples

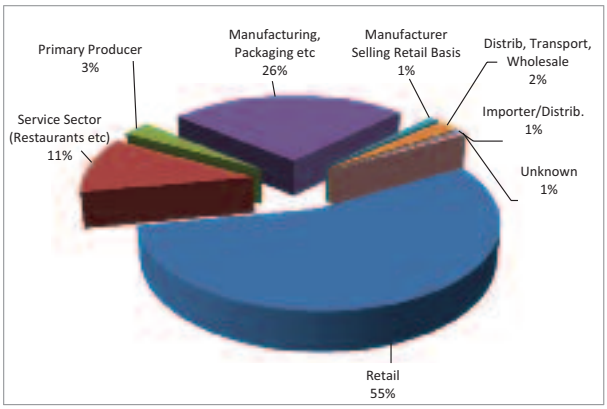


Table 2.2 HSE Food Sample Sources (2015 & 2016)

	2015		2016	
Community Care County Area E.H.O. Service (all sample types)	Number of Samples Submitted (excluding complaints)	Number per 1,000 population*	Number of Samples Submitted (excluding complaints)	Number per 1,000 population*
Galway	224	0.92	153	0.63
Mayo	119	0.93	102	0.80
Roscommon	70	1.10	58	0.91
Clare	115	1.11	95	0.91
Limerick	139	0.82	104	0.62
North Tipperary/East Limerick	161	1.51	105	0.99
Donegal	129	0.80	84	0.52
Sligo/Leitrim/West Cavan	75	0.77	81	0.83
HSE South	91	-	55	-
HSE Dublin Mid-Leinster	72	-	39	-
HSE Dublin North East	52	-	69	-

*Based on 2011 census.

2.3.3 Statistics for 2015 & 2016

See Table 2.2 for a breakdown of the samples analysed in 2015 and 2016 per head of population.

In 2015, the samples consisted of 136 complaints (see section 2.7) and 2,788 others. Out of the 2,788 samples, "Non-complying" reports (i.e. test results indicating non-compliances with standards in Irish Food Law) were issued on 185 (6.6 %).

In 2016, the samples consisted of 105 complaints and 1,497 others. Out of 1,497 samples, "non-complying" reports were issued for 122 (8.1 %) samples. These figures can be compared to the figures for previous years, see below:

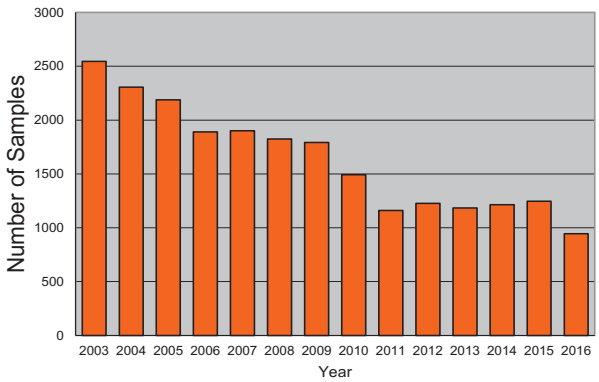
"Non-complying" Reports (as % of samples tested, excluding complaints).

Year	%	Year	%
2016	8.1	2009	6.4
2015	6.6	2008	7.4
2014	8.2	2007	8.3
2013	7.9	2006	5.4
2012	6.4	2005	4.7
2011	6.5	2004	5.0
2010	8.3		

Of the non-compliances found in 2015, 140 were due to labelling deficiencies while in 2016, 91 were due to labelling deficiencies, including, for example, issues in relation to non-authorised nutritional and health claims. Such labelling deficiencies also included foodstuffs where undeclared allergens were detected in a food, as well as discrepancies between the labelled and analytically determined values for the composition of the foodstuff (e.g. salt/sodium content). The categories of foodstuffs and infringements for complaints and other samples received from HSE West and the General Public are summarised in Appendix 2.

The Figure below indicates that samples received from the EHS appear to have stabilised (at ca. 1,200 p.a.) up to 2015, following a decrease from 2003 forward.

HSE EHS programmed samples (excluding food complaints) received.
Figure 1



2.3.4 Overall Summary of Data and Food Quality 2015 and 2016

Surveillance for allergens, contaminants, nutritional testing (salt, folic acid, mineral nutrients, sugars, etc.), additives and labelling was carried out in 2015 and 2016. Results are reported by test parameter in sections 2.4 - 2.6. Some instances of non-compliances were found and these were dealt with by the EHS and FSAI as appropriate.

As in previous years the results reported for 2015 & 2016 indicate a high level of chemical safety and legislative compliance, and a generally high quality of food.

Overall, a continuing low level of non-compliances due to food contamination is indicated. These results reflect the efforts being made in Europe, including Ireland, to ensure the safety and quality of our food supply.

Note:
To obtain an overall picture of the safety and hygiene of our food supply, see Annual Reports of FSAI, www.fsai.ie and those of the agencies (PALs Dublin and Cork, Dept. of Agriculture, Food and the Marine; Local Authorities; HSE Food Microbiology Labs, etc.) involved in the official control and surveillance of food.

2.4 Food Allergens, Contaminants etc.

2.4.1 General

Chemical contaminants, allergens and residues in foods are monitored to ensure their safety and legislative compliance. They include Natural Toxins, Industrial / Environmental Contaminants, Food Processing / Packaging Contaminants, Food Allergens, and Foreign Bodies / Food Complaints.

Notes:
(i) Other Official Agencies and FSAI (see Appendix 3 and www.fsai.ie) also monitor contaminants & residues in food. The Ashtown Food Research Centre (Teagasc) produces an annual National Food Residue Database for Ireland - (see http://nfrd.teagasc.ie/).

(ii) Data on microbiological contamination of food are to be found in the reports of the Official Food Microbiology Laboratories, in reports of other Departments/Agencies (see Appendix 3) and in FSAI (www.fsai.ie) reports.

2.4.2 Food Allergens and Related Testing (Histamine etc.)

2.4.2.1 Food Allergens

Food Allergies have recently received increased attention as a serious health concern. Recent reports suggest that 1 – 3 % of adults and 4 – 6 % of children suffer from a food allergy (EFSA Scientific Opinion on the evaluation of allergenic foods and food ingredients for labelling purposes..(NDA), EFSA Journal 2014;12 (11):3894). There has been, over recent years, a large increase in the availability of 'allergen-free' foods on the market, and a concomitant increased number of EU Rapid Alert Notifications (113 Notifications for Food Allergens in 2016, - see RASFF Preliminary Annual Report 2016, European Commission, D-G General for Health and Food Safety). These Alerts are issued because particular foodstuffs have been found to be unsafe for human consumption, or are otherwise in breach of food legislation. Food Allergen labelling problems were reported in 2013 as the most common cause of recalls of US FDA-regulated food products (Gendel et al., J Food Prot. 2013 Nov;76(11):1933-8).

Legislative Requirements for 'Allergen-free' Foods: 'Allergen-free' foods on the EU market must comply with EU food law. In particular, such foods must not be "Unsafe" (Regulation (EC) No 178/2002, general requirements of food law) for people with particular sensitivities, and they must not be "Misleading" (Regulation (EU) No 1169/2011, food information to consumers). At present, legislative limits for allergens in food exist only for gluten and sulphites.

HSE Role in Food Allergen Surveillance: HSE surveillance of food for allergens has been performed since the 1990s, with the initial focus being on gluten-free foods. During the late 1990s, one of the main food complaints concerned suspicion of the presence of gluten in so-called gluten-free foods. More recently the testing expanded to include several other food allergens, and the laboratory is now the national specialist laboratory for food allergen testing.

The HSE national sampling programmes include food allergens, focussing on foods labelled/presented as allergen-free (e.g. "Peanut-free"). This surveillance has to date used various, qualitative risk factors (including severity of reaction to allergen, published RASFF Alerts,

quantity of each 'allergen-free' food on market, product volume being produced/manufactured in Ireland, etc.) to decide on what allergens and what food types should be surveyed. In 2016, FSAI initiated a more formal, risk-based approach to this surveillance planning through its newly formed Allergens' Working Group.

Food Allergens and Related Testing 2015 and 2016 Table 2.3 summarises 2015 and 2016 testing results.

Gluten: Gluten proteins contained in wheat, barley, rye and their cross-bred varieties are toxic to coeliacs.

Table 2.3 Food Allergens and related parameters: Summary of Official Results for 2015 & 2016

Allergen/ Parameter	Limit(s) (Legal Source)	2015				2016			
		Sample Types	Total	Complying With Standard	Non-complying with standard	Sample Types	Total	Complying With Standard	Non-complying with standard
Gluten (EHO sampling)	20 mg/kg*	Gluten-free foods	216	210	6[1]	Gluten-free foods	209	204	5[2]
Gluten (DAFM)	20 mg/kg*	Infant Formula & Gluten-free sausages	21	21	0	Infant Formula	20	20	0
Gluten (LAVS)	20 mg/kg*	Gluten-free sausages	2	2	0	Gluten-free pork products	9	9	0
Peanut	Regulation (EU) 1169/2011 (FIC)	Confectionery (28), Bakery Products (20), Spices (22), Prepared Meals (6), Soya Spreads (2), Seeds (2), Muesli (1), Canned Veg. (2), Meat (1) & Sauces (4)	88	88[3]	0	Chocolate (12), Bakery Products (27), Spices (3), Cereals (2), Ice-cream (1), Prepared Meals (6), Sauces (2) & Snack (1)	54	53[4]	1[5]
Pecan	Regulation (EU) 1169/2011 (FIC)	Biscuits	1	1	0	-	-	-	-
Hazelnut	Regulation (EU) 1169/2011 (FIC)	Bakery Products (13), Confectionery (14),Desserts (2), Soya Drink (1), Cereals (1) & Sauce (1)	32	31[6]	1[7]	-	-	-	-
Egg	Regulation (EU) 1169/2011 (FIC)	Cake mixes (6), Fajita kits (4), Biscuits (5), Confectionery (3), Pastas (2), Sauce (1), Seasoning (1) & Canned Veg. (2)	24	24	0	Bakery Products (8), Chocolate Teacakes (2), Snacks (4), Sauces (5), Pasta (2), Ice-cream (1) & Sausage Rolls (1)	23	23[8]	0
Casein (EHS)	Regulation (EU) 1169/2011 (FIC)	Coconut Milks (14), Coconut Waters (12), Coconut Juices (2),Chocolate (10), Soya Products (7), Desserts (3), Spreads/Pastes (3) & Bread (1)	52	48[9]	4[10]	Chocolate (6), Cookies (1), Corn Chips (1),Oat-based drink (1), Sauce (1),Spread (1) & Soya Milk (1)	12	11	1[11]
Sulphites	Reg. (EU) 1169/2011, Regulations 1333/2008 & 1129/2011	Meat & Meat products (80), Fruit/Veg (51), Beers/Ciders/Wines (36), Soft Drinks (1), Prawns (2)	170	157	13[12]	Meat & Meat products (64), Fruit/Veg (34), Beers/Ciders/Wines (47), Prawns (3), Granola (1)	149	138	11[13]

* *Regulation (EC) 41/2009 or Commission Implementing Regulation (EU) No.828 of 2014, given effect by S.I. No.389 of 2016 (came into force 20/07/2016).*

1. *Three gluten-free bakery products, one gluten-free meat product, one gluten-free dessert and one gluten-free snack sample.*
2. *Four gluten-free bakery products and one gluten-free cereal.*
3. *Four spice samples were found to have detectable levels of Peanut present. No "nut or peanut free" claim was made nor were any sources of peanuts present in the ingredients' list on the samples' packaging, therefore, these samples were not designated.*
4. *Two prepared meals were found to have detectable levels of Peanut present and there was no indication at the point of sale that these samples were "Peanut free", therefore, these samples were not designated.*
5. *A take-away (prepared) meal (food complaint) was found to have a high level of Peanut present, and it was sold as "nut free".*
6. *A Chocolate Biscuit Cake and a Spread were found to have detectable levels of Hazelnut present and were sold as "nut free", however, it was also noted that the following "may contain nut traces" was also declared on the samples' packaging, therefore, both samples were not designated.*
7. *A bakery product (food complaint).*
8. *Two samples of the same confectionery product were found to have low levels of egg present. No "egg free "claim was made nor were any sources of egg present in the ingredients' list on the samples' packaging, therefore, these samples were not designated.*
9. *A Coconut Milk was found to have a detectable level of Casein present, however, no dairy-free claim was made nor were any sources of dairy present in the ingredients' list on the samples' packaging, therefore, this sample was not designated.*
10. *Three Coconut Milks and a Coconut Juice.*
11. *A sample of Corn Chips.*
12. *12 of these samples were non-compliant with the additives legislation (Regulation (EC) No 1333/2008 as amended by Regulation (EC) No 1129/2011 for excessive SO_2 or non-permitted SO_2. 1 sample had undeclared Sulphur dioxide.*
13. *6 of these samples were non-compliant with the additives legislation (Regulation (EC) No 1333/2008 as amended by Regulation (EC) No 1129/2011 for excessive SO_2 or non-permitted SO_2. 5 samples had undeclared Sulphur dioxide.*

On 20th July 2016 Commission Implementing Regulation (EU) 828/2014 (repealing Regulation (EC) No.41/2009) came into force and sets limits as follows:

• 20 mg/kg for naturally gluten-free foods.
•100 mg/kg for "very low gluten" foods, having one or more gluten-containing ingredients.

There is also an additional requirement for food containing oats which have been specially produced in a way to avoid contamination by wheat, rye, barley, or their crossbred varieties: i.e. no more than 20mg/kg gluten in such oats is permitted.

In 2015 & 2016, a diverse range of gluten-free foods was received. There were 6 samples in 2015 and 5 samples in 2016 (HSE programmed samples) labelled as gluten-free and found to be non-compliant (with gluten levels > 20 mg/kg); these consisted of bakery products (7), meat products (1), Cereal mix (1), Snack (1) and Dessert (1). Follow-up action was taken by the authorised officers. The results for mainstream, pre-packaged produce once again indicate an overall high quality (with respect to gluten levels) of gluten-free foods available to the consumer.

A number of private food samples were also tested (820 in 2015 and 107 in 2016). This testing has been carried out for a number of years now, generally in association with the Coeliac Society of Ireland (CSI), in support of their work on listing products in the CSI Gluten-free Foods Book. As the R5 ELISA testing is now more commonly available, this lab has a much reduced involvement in the above work. Standard advice is now given to the GF producers, and to CSI, on the testing requirements (test method, laboratories etc). In addition to the CSI work above, testing of ca. 600 gluten-free oats samples was performed in 2015, in support of an R & D project aimed at developing the large-scale production of Gluten-free Oats in Ireland.

Peanut: An ELISA-based analysis for Peanut in foods, based on the use of polyclonal antibodies to the allergenic peanut proteins Ara h1 and Ara h2, is in use in this laboratory. A total of 142 samples (i.e. 88 in 2015 and 54 in 2016) consisting of various food types (i.e. confectionery, bakery products, prepared meals, spices, sauces etc) was tested for the presence of peanut, with an emphasis on products labelled as nut- or peanut-free. The programmed testing indicated no non-compliances. One non-compliance (in 2016) was obtained for a complaint sample, a prepared meal (sold as "nut-free") involving anaphylaxis and hospitalisation. The sample was found to contain peanut at 1220 mg/kg, an extremely high level, unsafe for a peanut allergy sufferer. This particular case indicates the risks involved for peanut allergy sufferers in obtaining peanut-free foods at takeaway/catering level.

Hazelnut: 32 samples (consisting mainly of bakery products, confectionery etc) were analysed in 2015 for the presence of Hazelnut using an ELISA kit specific for the detection of Hazelnut in foods. The programmed testing indicated no non-compliances. One food complaint sample, a croissant, was received for testing; it was found to contain hazelnut at > 200 mg/kg, i.e. a level sufficiently high to be associated with an adverse reaction.

Egg: A total of 47 samples (i.e. 24 in 2015 and 23 in 2016) consisting of various food types (i.e. bakery products, cake mixes, confectionery, pastas etc) was analysed for the presence of egg, with an emphasis on products labelled as "egg-free". The testing indicated no non-compliances; however, 2 samples of the same product were 'not designated' since a low level of egg was detected but there was no 'egg-free' claim on the samples' packaging.

Casein: A total of 64 samples (52 in 2015 and 12 in 2016) consisting of various food types (i.e. coconut milks, waters & juices, confectionery, soya products etc) were analysed for the presence of casein (casein is a milk protein), with an emphasis on products labelled as "dairy-free" or "non-dairy". The testing indicated 5 non-compliances (i.e. 3 Coconut milks & a Coconut juice in 2015, and a snack product in 2016).

Food Allergen Testing - Developments and Challenges

Limitations of Food Allergen Testing: Quantitative testing for food allergens in Europe is carried out in the main using ELISA methodologies, supported by DNA (PCR) techniques. Recently, LC-MS methods have begun to show their worth as sensitive and specific techniques. However, ELISA methods, although they have the advantage of estimating the allergenic material (protein) present, have several disadvantages: in particular they are not selective enough for all food types on the market. The ELISA kits may be subject to interferences (e.g. cross-reactivities) from other ingredients present in the food. Different kits use different antibodies and this often results in different test results for the same sample, i.e. depending on what manufacturer's kit is used. In recognition of the above problem of different results from different ELISA methods, FAPAS, a food Proficiency Test Scheme (i.e. ring tests of food samples to be tested as 'unknowns') , assesses the performance of laboratories based on the ELISA Test kit used (as opposed to issuing just one consensus value). In addition to the above problem of lack of consistency between ELISA Test kit results, the laboratory has difficulty in having confirmatory testing performed, due to differences in the exact test parameters measured by other methodologies. For example, PCR methods measure the DNA, not the actual allergenic material, i.e. protein. Some form of confirmatory testing of preliminary results is important as enforcement actions can result in serious consequences for the food manufacturer, i.e. issue of a Food Alert (RASFF) or an FSAI Allergen Alert. Of the so-called 'confirmatory' methods, LC-MS appears to be the most promising, but more progress needs to be made in this area. In the area of Proficiency Testing (ring tests), whilst much progress has been made, the range of matrices (food types) is not yet extensive enough. Similarly the lack of adequate matrices for Certified Reference Materials and Lab Reference Materials is an impediment to ensuring that each lab can be confident in the reliability (specificity and sensitivity) of its measurement results, especially at low levels of allergen. The above issues cause problems for the labs in achieving accreditation for an adequate range of food types, in particular as new food types are continuously being encountered, and the cross-reactivity of new food ingredients is often not known.

Reporting and Designation of Food Allergen Results: Each test result is reported, and also designated, i.e. "compliant" or "non-compliant", against the legislative standard(s). Such designation of results is agreed with FSAI, so as to conform to EFSA/EU requirements. The designations are made w.r.t. compliance or non-compliance with specified food law, relating to safety and consumer information. In view of the potentially high-risk significance of any positive allergen results, the laboratory needs to be able to assess whether the results need immediate repeating or reporting. In Food Allergen Testing, the laboratory results can quickly give an estimated intake of dose (in milligrams), by simple combination of the test result (concentration) and the likely amount of the food consumed. Such estimated intake can be compared to published Eliciting Doses (ED), e.g. ED01s, for the allergen of concern. The Eliciting Dose represents the best estimate from clinical studies of the dose likely to elicit an allergic reaction in a specified cohort of allergy sufferers. The laboratory may need to urgently report results to the Authorised Officer and to FSAI for a risk assessment.

Future Developments and Required Actions: Despite the difficulties involved in food allergen surveillance, HSE and FSAI have agreed that food allergens' surveillance is nonetheless valuable and that we cannot wait until all the analytical difficulties are sorted out. In particular, the testing is required in cases of food complaint and incidents of allergic reactions, involving supposedly allergen-free foods. This is important because of the 'acute' nature of food allergy and the potential significance of even small amounts of allergen in a food. The laboratory is reviewing its allergen testing procedures etc. with a view to widening its confirmatory methods. It is intended to introduce LC-MS testing, for confirmatory work initially, and also for screening work. The difficulties and challenges of Food Allergens' Testing apply equally to other official EU food laboratories, and to address them a workshop has been organised by the Joint Research Centre in Geel, Belgium. **Central to this work is the establishment of an infrastructure for the harmonisation of food allergens measurement in the EU.**

FSAI has an involvement in this group and it is our intention to have immediate participation in the group.

2.4.2.2 Biogenic Amines

Biogenic amines, including histamine, are natural toxins which may be present in foods such as scombroid fish, e.g. tuna, mackerel. If stored inappropriately, such foods may produce elevated histamine and other biogenic amines; excessive levels are associated with histamine- or scombroid-poisoning. Histamine poisoning is an allergy-like intoxication. Commission Regulation (EC) No. 2073/2005, and amendments, sets standards for histamine and fish products. See Table 2.4 for Summary of Sample testing in 2015 and 2016

Table 2.4: Summary of Biogenic amines Testing 2015 and 2016

Sample Type	Sample Source	2015			2016		
		Total	Compliant	Non-compliant	Total	Compliant	Non-compliant
Scombroid Fish	EHOs	73	71	2	64**	62	1
Cheese	EHOs	17	17	0	15	15	0
Fish Sauce	BIP	1	1	0	1	1	0
Food Complaints	EHOs	1 (Cheese)	1	0	2 (Fish)	2	0
Fish	SFPOs	14 (x9)*	14	0	13 (x9)	13	0
Fish (BIP)	DAFM-BIP	3 (x9)	3	0	2 (x9)	2	0
All Types	**All Sources**	**109**	**107**	**2**	**97****	**95**	**1**

SFPOs: Sea-Fisheries Protection Officers, DAFM-BIP: Dept. of Agriculture, Food & Marine - Border Inspection Post
** (x 9) means that each sample consisted of 9 x individual sub-samples*
*** One sample was not designated on approval, as the sample arrived into the laboratory at 15.5°C*

Fish: 90 fish samples were tested here in 2015 for Histamine and 3 other biogenic amines, viz. Putrescine, Tyramine and Cadaverine. 2 of the 90 samples had excessive Histamine, and 3 samples contained elevated (>100 mg/kg) Cadaverine. 81 fish samples were tested here in 2016. Just 1 of the 81 samples had excessive Histamine.

Cheese: Surveys on the Biogenic Amine content of cheeses were carried out in 2015 (18 samples - 12 raw and 6 'pasteurised') and in 2016 (15 samples - 12 raw and 3 'pasteurised'), - see Table 2.5 for results. Samples were sourced from markets etc.

Table 2.5: Results for Biogenic amines in Cheese Surveys

Cheese Type	Biogenic amine	2015 No. of samples in Range of Results (mg/kg)			2016 No. of samples in Range of Results (mg/kg)		
		<100	100-600	>600	<100	100-600	>600
Raw	Histamine	8	4[1]	0	10	2[5]	0
	Putrescine	9	3[2]	0	9	2[9]	1[6]
	Tyramine	5	6[3]	1	6	3[7]	3[10]
	Cadaverine	10	1	1[4]	10	0	2[8]
Pasteurised	Histamine	6	0	0	3	0	0
	Putrescine	6	0	0	3	0	0
	Tyramine	5	1[11]	0	3	0	0
	Cadaverine	6	0	0	3	0	0

1 *Histamine levels: 172, 211, 277, 322 mg/kg*
2 *Putrescine levels: 295, 357, 496 mg/kg*
3 *Tyramine levels: 120, 142, 178, 257, 343, 600 mg/kg*
4 *Cadaverine level: 625 mg/kg*
5 *Histamine levels: 137, 469 mg/kg*
6 *Putrescine level: 627 mg/kg*
7 *Tyramine levels: 130, 195, 262 mg/kg*
8 *Cadaverine levels: 809, 1406 mg/kg*
9 *Putrescine levels: 101, 140 mg/kg*
10 *Tyramine levels: 687, 721, 1826 mg/kg*
11 *Tyramine level: 152 mg/kg*

As expected, most of the samples with elevated amines were raw-milk cheeses, generally low levels being detected in the pasteurised-milk cheeses.

For a general report on Histamine poisoning see http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/Seafood/FishandFisheriesProductsHazardsandControlsGuide/ucm091910.htm

2.4.2.3 Lactose and Galactose in various foods

Galactose, a monosaccharide sugar, is toxic to persons suffering from Galactosemia, a metabolic disease; so too is Lactose, which can break down to its constituent monosaccharides (Galactose and Glucose). In 2016 the laboratory began to collaborate with Temple Street Childrens' Hospital on the determination of 'Total Galactose' in a variety of food samples. This testing started initially with surveys of Cheese and Spreads, tested for Galactose and Lactose using an Ion Chromatographic method.

23 samples of various brands of cheese (mature cheddar etc.) were tested. The results confirmed that a number of cheeses tested had effectively no lactose or galactose present, i.e. both lactose and galactose were below the limits of quantification (both <10 mg per 100g of cheese). 9 samples of various spreads (dairy spreads, vegetable spreads, butter and margarine) were tested and, as expected, a wide range of results (12 to 230 mg of 'Total Galactose' per 100 grams of spread) was obtained, related to the percentage of 'milk' in the product. The term 'Total Galactose' refers to a summation of any galactose detected, plus galactose potentially released from lactose (assuming 100% conversion).

It is intended to continue this work in 2017.

2.4.3 Food Contaminants – EC Regulation 1881/2006 and Others.

EC Regulation 1881/2006 (& 333/2007, 1126/2007, 629/2008, 420/2011 - amending) sets limits for a range of chemical contaminants in food. Relevant testing results for 2015 and 2016 are summarised in Table 2.6. Contaminant testing has decreased significantly here as many of the Contaminants Specialisations are now in the P.A. Laboratories in Dublin and Cork. Also, other official laboratories (DAFM) perform significant surveillance in this area.

Table 2.6: Food Contaminants EC Regulation 1881/2006 and Others – Main Official Results for 2015 & 2016

Contaminant	Sample types (2015 Nos. /2016 Nos.)	2015			2016		
		Total	Complying	Non-complying	Total	Complying	Non-complying
Lead[1]	Infant/Follow-on Formula/Weaning Foods (46/20); Edible Seaweed (21/21); Casein (17/0); Supplements etc (4/4); Miscellaneous (1/0)	89	89	0	45	45	0
Cadmium[1]	Infant/Follow-on Formula/Weaning Foods (47/53); Edible Seaweed (21/21); Casein (17/0); Supplements etc (4/4); Miscellaneous (1/3)	90	90	0	81	81	0
Mercury[1]	Supplements etc (4/0); Miscellaneous (1/1)	5	5	0	1	1	0
Arsenic[2]	Infant/Follow-on Formula/Weaning Foods (46/53); Edible Seaweed (21/21); Casein (17/0); Supplements etc (4/4); Miscellaneous (1/3)	89	89	0	81	81	0
Nickel[3]	Infant/Follow-on Formula/Weaning Foods (16/27); Edible Seaweed (0/13); Supplements etc (2/3)	18	18	0	43	43	0
Marine Biotoxins [4&5]: DSP, AZA & ASP Toxins[6]	Mussels, Oysters, Scallops, Clams, Crab	8	8	0	13	13	0
Propylene glycol etc	Vodka and Wine (Complaint samples, - see Section 2.7)	0	0	0	10	10	0

[1] Commission Regulation (EC) No. 1881/2006 and amendments [2] S.I. No. 44 of 1972 [3] No legislative limits
[4] Regulation (EC) No. 853/2004, Commission Regulation (EU) No. 15/2011
[5] These toxins may accumulate in shellfish grown in seawater with excessive marine algae. Retail/Catering level (largely) sampling by EHO service. Analysis out-contracted to Marine Institute. Principal official monitoring is at production level by DAFM/Marine Institute.
[6] Diarrhetic Shellfish Poisoning (DSP), Azaspiracid (AZA), Amnesic Shellfish Poisoning (ASP)
Note: Private samples of shellfish, seaweed and supplements were also analysed in 2015 (42 samples) and in 2016 (95 samples) of which one sample was non-compliant for Lead in 2016. Three private shellfish samples were deemed non-compliant for Cadmium in 2015 and a further eight in 2016.

2.4.4 Surveillance of Bottled Waters

HSE surveillance of bottled waters (mineral, spring and others) is coordinated nationally.

187 samples of bottled water were examined here in 2015, and 156 in 2016, the majority from domestic water bottling plants (Natural Mineral Water, Spring Water & 'Other' bottled ground water). A breakdown of sample sources for surveillance samples and other samples is given in the Table below.

	2015	2016
Programmed Survey/ Routine (EHOs)	179	141
Repeat/Follow-Up (EHOs)	2	3
National Standards Authority of Ireland (NSAI)	0	9
Complaints etc	6	3
Total	187	156

National testing covers Audit suites (see Waters/Effluents, Section 3 of this Report for more details on the tests involved), including chemical and microbiological parameters (testing performed separately in the microbiology labs) as set out in S.I. No. 282 of 2016.

For 2015, 163 samples were received for Audit testing, 20 for VOCs only, and 4 for VOCs and Audit. 2 samples were not designated as they had elevated Barium (2.4 and 2.3 mg/L). There are no legislative limits for Barium but bottled waters typically have values of <0.5 mg/L.

In addition to the programmed surveillance above: 6 complaint samples (4 via EHOs, and 2 directly from public) were examined in context of various issues, including objectionable odour.

For 2016, 138 samples were received for Audit testing, 16 for VOCs only, and 2 for VOCs and Audit. 8 bottled water samples were found to be non-compliant for labelling issues. 21 samples were non-designated of which 13 were "Source Well" samples, 7 for labelling issues and 1 for an objectionable odour.

In addition to the programmed surveillance above: 3 complaint samples (2 via EHOs, and 1 direct from public) were tested in 2016.

All of the remaining programmed samples received were found to comply with the compositional criteria as given in S.I. No. 282 of 2016. All bottled water samples were screened (by ICP-MS) for metals as per S.I. No. 282 of 2016 and none were found to exceed their legislative limits.

2.5 Nutritional and Compositional Testing

2.5.1 Sodium/Salt in Food

A considerable international effort is being made to reduce population dietary intake of 'Salt'/Sodium, - see e.g. "Salt and Health: Review of the Scientific Evidence and Recommendations for Public Policy in Ireland", www.fsai.ie/uploadedFiles/Science_and_Health/salt_report-1.pdf. Because of the public health significance of excessive salt intake, the FSAI has implemented a policy, in association with the food industry, of programmed reduction of salt levels in the major, salt-containing, processed foods. An ultimate maximum intake of 4 g salt per day is recommended. This laboratory performs the testing on behalf of FSAI.

The 2015 & 2016 results for the FSAI surveys are summarised in Table 2.7.

Table 2.7: Summary of FSAI Surveys - 'Salt' (Sodium & Potassium) Results for the Years 2015 & 2016

YEAR 2015

Food Types etc.		Samples Tested	Average Results[1] (g/100g)	Sodium/ Potassium Ratio
Dairy & Non-dairy Spreads Survey	Sodium	90	0.50	16.7
	Potassium	90	0.03	
Breads Survey	Sodium	142	0.43	2.5
	Potassium	142	0.17	
Breakfast Cereals Survey	Sodium	150	0.29	1
	Potassium	150	0.29	
Meats Survey	Sodium	148	0.83	3.3
	Potassium	148	0.25	
	TOTAL	530		

YEAR 2016

Food Types etc.		Samples Tested	Average Results[1] (g/100g)	Sodium/ Potassium Ratio
Sauces Survey	Sodium	88	0.36	1.8
	Potassium	88	0.20	
Snacks Survey	Sodium	59	0.75	0.8
	Potassium	59	0.95	
	TOTAL	147		

[1] In the calculation of the average result in each category, the value (<0.01g/100g) has been replaced by 0.005g/100g and the value (<0.03g/100g) has been replaced by 0.015g/100g.

The 2015 and 2016 surveillance work above for FSAI is a continuation of the work dating from 2003, see FSAI report "Monitoring of Salt in Processed Foods – September 2003 to June 2015" for further details - http://www.fsai.ie/uploadedFiles/Science_and_Health/Salt_and_Health/Salt_Surveys_2003_onwards.pdf

The workload in 2016 has decreased substantially and the intention is that, within a policy of National Reformulation, the work be extended to Salt, Sugars and Fat.

HSE Regional Surveys: as part of the national, programmed HSE food surveillance, several 'salt' surveys were carried-out in 2015 & 2016 - see Table 2.8.

Table 2.8: Summary of Salt Surveillance - HSE Food Surveys.

	Number of Samples		Designation of Results			
Survey Food Types etc	2015	2016	2015 Complying	2015 Non-complying	2016 Complying	2016 Non-complying
Weaning Foods[1]	33	36	33	0	35	1[1]
Infant & Follow-on Formula	16	29	16	0	29	0
Ethnic Foods[2]	21	31	15	6[2]	24	7[2]
Body Building Foods & Supplements	16	17	12	4[3]	16	1[3]
Christmas Bakery Products	34	27	34	0	27	0
Low Salt/Reduced Salt Survey	16	20	16	0	20	0
Locally Produced Bakery Products[4]	8	-	8	0	-	-
Foods for special medical purposes	-	9	-	-	9	0
Miscellaneous	12	3	10	2[5]	0	3[5]
Bottled Waters Survey[6]	167	140	167	0	140	0
Total	323	312	311	12	300	12

[1] This survey includes cereal-based/powdered baby foods, ready-to-eat prepared dinners/desserts for babies & growing up milks for toddlers. In 2016 there was one cereal-based baby food found to contain excessive Potassium.
[2] A variety of foodstuffs was submitted in this survey including Meat & Meat Products, Sauces, Seasonings, Snacks, Cereal & Bakery Products, Breakfast Cereal, Prepared Meals etc. In 2015, 6 samples, and in 2016, 7 samples, were found to have Sodium levels outside of the acceptable tolerance (specified in the EU Guidance Document on nutritional labelling tolerances).
[3] In total there were 5 samples (i.e. 4 in 2015 & 1 in 2016) found to have Sodium levels outside of the acceptable tolerance.
[4] This survey consisted of Apple & Rhubarb Crumbles etc (uncooked (4) & cooked (4).
[5] In 2015, 2 samples (a bakery mix & a bakery product) and in 2016, 3 samples (2 fish & 1 meat product) were found to have excessive Sodium levels outside of the acceptable tolerance.
[6] Samples analysed in the Water Laboratory as part of an Audit suite of analysis.

These HSE surveys monitor foodstuffs to ensure that manufacturers are complying with Regulation (EU) 1169/2011 (FIC) regarding the declaration of their labelled Salt/Sodium levels.

2.5.2 Monitoring of Folic Acid:

Over the last number years the laboratory has performed testing on behalf of the FSAI with the aim of providing data for all fortified (with folic acid) foods on the market in Ireland. Much of this surveillance has recently been incorporated into the HSE national food surveillance programme. In 2015, 136 samples were tested here (see Table 2.9 for details).

The determined folic acid values are compared to their labelled values (EU Guidance Document on Nutritional Labelling Tolerances applies) or to other, set standards, - such standards include legislative limits for folic acid, e.g. a range of 10-50µg/100kcal for Infant Foods (S.I. No.852 of 2007). Of the 136 samples tested, 11 were non-compliant with the legislative limit or were considered as "misleading" (using the EU Nutritional Tolerances document...). 120 results were "compliant". Results for 5 samples were "Not designated" for a number of reasons, including in situations where the labelled information was not clearly presented. In 2016, 96 samples in total were tested, and 15 were non-compliant with the legislative limit or were "misleading".

The surveillance included food supplements samples, 26 tested in 2015 (4 samples were found to be non-compliant), and 18 tested in 2016 (5 samples were found to be non-compliant) .

2.5.3 Nutritional/Mineral Elements Testing in 2015 & 2016

Table 2.10 summarises Nutritional/Mineral Elements testing results for 2015/16. This testing was recently introduced here. It is valuable in monitoring the mineral levels in processed foods supplemented with minerals, e.g. infant formula, food supplements etc. The potential exists for mis-formulation of the added minerals.

Test results for the various minerals are checked for compliance with:

• Set legislative ranges, e.g. Infant Foods (SI No 852 of 2007), or ranges set in internationally accepted guidance documents, e.g. ESPGHAN (2010) recommendations for pre-term formula,
or with

• The manufacturer's labelled value, using the tolerances given in EU Guidance Document on Nutritional Labelling Tolerances, December 2012.

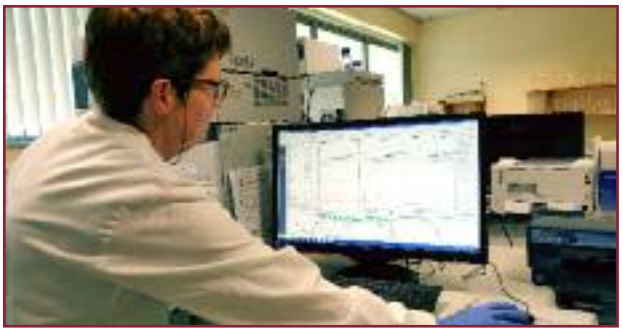


Table 2.9: Folic Acid Testing 2015 & 2016

Food Types etc.	Samples Tested 2015	Range of Results 2015	Samples Tested 2016	Range of Results 2016
Cereal-based Weaning Foods-HSE survey	12	<8-35µg/100kcal (74-133% Labelled Value)	1	<7µg/100kcal
Infant and Follow-on Formulae-HSE survey	17	11-29µg/100kcal (57-175% Labelled Value)	19	14-52µg/100kcal (75-150% Labelled Value)
Infant-and Follow-on Formulae-DAFM survey	21	12-29µg/100kcal (90-172% Labelled Value)	20	15-33µg/100kcal (105-204% Labelled Value)
Breakfast Cereals (including Wheat, Corn, Rice, Bran Oat-based)-HSE survey	17	134-439µg/100g (63-224% Labelled Value)	18	<30-395µg/100g (60-189% Labelled Value)
Bread (including white, brown, multigrain, spelt….)	19	<30-210µg/100g (82-131% Labelled Value)	5	<30-232µg/100g (72-145% Labelled Value)
Fruit Juices	10	23-204µg/100ml (115-367% Labelled Value)	-	-
Milk	14	<4-103µg/100ml (82-147% Labelled Value)	9	25-135µg/100ml (71-183% Labelled Value)
Spreads (dairy- & oil-based)	0	-	5	206-763µg/100g (94-132% Labelled Value)
Yeast Extract Spread	0	-	1	47µg/100g (7% Labelled Value)
		Range of Results (2015) as % of Labelled Value		Range of Results (2016) as % of Labelled Value
Folic-acid-only Supplements,	18	94-130%	2	108% & 114%
Multi-vitamin Supplements etc.	8	47-180%	16	5%-176%
All Food Types	136	-	96	-

Table 2.10: Nutritional/Mineral Elements Testing 2015 & 2016

Mineral Element Results 2015: Non-complying results out of total results (per food group)								
Mineral Element	Vitamins/ Supplements		Body-building Supplements		Infant Formula/Follow-on Formula/Weaning Foods		Miscellaneous[15]	
	Total tested	Non-compliant	Total tested	Non-compliant	Total tested	Non-compliant	Total tested	Non-compliant
Boron	9	0	6	0	45	0	1	0
Magnesium[1]	14	1[2]	6	1[6]	48	0	1	0
Manganese[1]	13	0	6	0	48	0	1	0
Iron[1]	12	0	6	2[7]	48	0	1	0
Cobalt	11	0	6	0	47	0	1	0
Copper[1]	10	0	6	2[8]	48	0	1	0
Zinc[1]	13	0	6	0	34	0	1	0
Molybdenum[1]	11	1[3]	6	0	47	0	1	0
Chromium[1]	4	1[4]	1	0	35	0	38	0
Selenium[1]	3	1[5]	1	0	35	0	26	0

Mineral Element Results 2016: Non-complying results out of total results (per food group)								
Mineral Element	Vitamins/ Supplements		Body-building Supplements		Infant Formula/Follow-on Formula/Weaning Foods		Miscellaneous[15]	
	Total tested	Non-compliant	Total tested	Non-compliant	Total tested	Non-compliant	Total tested	Non-compliant
Boron	1	0	0	0	35	0	0	0
Magnesium[1]	4	0	6	0	55	0	10	0
Manganese[1]	4	0	5	0	55	0	0	0
Iron[1]	6	0	4	2[9]	55	0	2	1[10]
Cobalt	2	0	6	0	35	0	1	0
Copper[1]	4	0	3	2[11]	56	0	0	0
Zinc[1]	5	0	6	0	55	0	1	0
Molybdenum[1]	3	1[12]	0	0	35	0	1	0
Calcium[1]	1	0	0	0	0	0	0	0
Chromium[1]	3	1[13]	2	0	52	0	25	0
Selenium[1]	2	1[14]	1	0	34	0	25	0
Iodine[16]	0	0	0	0	0	0	6	0[16]

1 *Commission Directive 2006/141/EC, Commission Directive 1999/21/EC, Commission Directive 2006/125/EC*
2 *47% of the labelled amount observed*
3 *173% of the labelled amount observed*
4 *176% of the labelled amount observed*
5 *>16000% of the labelled amount observed*
6 *43% of the labelled amount observed*
7 *31% & 277% of the labelled amounts observed*
8 *180% & 283% of the labelled amounts observed*
9 *166% & 325% of the labelled amounts observed*
10 *One snack sample with 56% of the labelled amount observed.*
11 *155% & 257% of the labelled amounts observed*
12 *171% of the labelled amount observed*
13 *187% of the labelled amount observed*
14 *68% of the labelled amount observed*
15 *In 2015, Miscellaneous samples consisted of 17 caseins and 21 seaweeds; in 2016: 21 seaweeds, 3 salt and 1 kale*
16 *Testing out-contracted. 6 x results for Energy Bars were referred to the FSAI for assessment of the levels of iodine detected.*

Food Supplements' Results (2015 and 2016 combined)

Of the tested samples, individual mineral levels ranged between 31 and 325 % of their labelled values. 16 results were outside the acceptable tolerances (vs. labelled values), and they were designated as breaches of the legislative standards.

Selenium mis-formulation

In 2015, one food supplement contained a seriously excessive amount of Selenium (Se), > 160 times the labelled value, arising out of mis-formulation at the manufacturing stage. The case was dealt with by the FSAI and the Environmental Health Officers involved. Similar mis-formulations have in the past been responsible for outbreaks of acute Selenium poisoning.

All Infant Formula tested complied with their standards, indicating accurate labelling for this type of product. See Table 2.10 and Section 2.5.5 for test results etc on food supplements.

2.5.4 Sugars in Fruit Juices, Fruit Drinks etc, Yoghurts

There has been an increased concern about the high, population-wide intake of sugars and its association with obesity. The approach by FSAI of national salt reduction is being extended to also include sugars and fat, as part of a national Food Reformulation initiative with the food industry. In 2015 the laboratory, with funding provided by FSAI, purchased an Ion Chromatograph for testing of sugars (sucrose, fructose, glucose…) in processed foods on the market. The intention was that the total sugars content of general foods can be determined and compared to the labelled value (to monitor labelling compliance), or to industry-targeted values (to ensure that proposed reductions are being achieved).

A survey of 21 Fruit Juices, Fruit Drinks and Smoothies was carried out in 2015, with testing for sucrose, fructose and glucose. 18 of the samples complied with the EU Tolerances (as stated in EU Guidance Document on Nutritional Labelling Tolerances, December 2012) set for sugars, and 3 samples had slight variations from their labelled values. Although only a small survey, these preliminary results overall suggest reasonably well labelled sugar levels.

19 samples of yoghurt and 1 mousse were received in 2016. The samples were tested for 5 sugars (sucrose, galactose, glucose, fructose and lactose). Total sugars content in the yoghurts varied widely, between 3.0 and 14.4 g/100g; the determined sugars ranged from 63% to 143% of the labelled values.

2.5.5 Food Supplements

Food supplements complement the normal diet, and they are covered in law by Directive 2002/46/EC (as amended), transposed into Irish law by the European Communities (Food Supplements) Regulations – S.I. No. 506 of 2007, as amended.

The HSE food surveillance group, working in association with FSAI, has recently focused increased attention on control of Food Supplements, including inspection/audit and also a surveillance/testing dimension. Surveys are coordinated nationally and chemical testing (different specialised testing) is generally performed by each of the three Public Analyst Laboratories.

Two surveys of food supplements were scheduled into the HSE national programme for 2015. Table 2.11 summarises results of testing in this lab for the two surveys.

2.5.5.1 HSE National Survey of Food Supplements' Manufacturers:

2015: In this survey, there were 28 detected non-compliances: 4 had levels of folic acid in variance with labelled values, 3 had discrepancies between the labelled value and the determined value for minerals, one was found to be irradiated but this was not declared on its label, and 20 had general labelling related non-compliances.

2016: In 2016, a national survey of 50 market-level food supplements containing caffeine was carried out. The analyses were performed in the Public Analysts' Labs in Cork and Dublin. The results of this survey will be published in 2017.

2.5.5.2 Imported Body-building Supplements

2015: 14 non-complying results were found in this survey, - see Table 2.11 for details.
2016: 7 non-complying results were found in this survey, - see Table 2.11 for details.

Table 2.11: Summary Results for Food Supplements Surveys 2015 & 2016

2015 Survey	Sample Numbers Received[2]	Test Parameters and Non-compliant results[1]					
		Folic Acid	Minerals/Metals (Cr, Se, Mg, Fe etc)[3]	Food Irradiation[4]	DMAA[5]	DMBA[6]	Labelling[7]
Supplements from Irish Manufacturers[8]	48	4/8[9]	3/13[10]	1/30	Not Tested	Not Tested	20/48
Imported Body-building Supplements[11]	33	Not Tested	3/7[10]	0/30	0/29	0/29	11/22
2016 Survey	**Sample Numbers Received**	**Test Parameters and Non-compliant results[1]**					
		Folic Acid	Minerals/Metals (Cr, Se, Mg, Fe etc)[3]	Food Irradiation[4]	DMAA[5]	DMBA[6]	Labelling[7]
Imported Body-building Supplements[11]	28	1/4[9]	4/7[10]	0/25	0/28	0/27	2/3

1 *E.g. 1/30 indicates that 1 sample was non-compliant with standard, out of 30 tested for that parameter.*
2 *Programmed number of samples in: 2015 Irish manufacturers' survey : 50 (25 manufacturing samples, 25 wholesale samples); Imported Body-building supplements' survey: 30. 2016 Imported body-building supplements survey: 28.*
3 *Tested parameters: Cr, Se, Mg, Mn, Mo, B, Fe, Cu, Zn, Ni, As, Pb and Cd, depending on sample (see Table 2.10 above)*
4 *Food Irradiation screening test (PPSL)*
5 *DMAA = Dimethylamylamine (stimulant)*
6 *DMBA = Dimethylbutylamine (stimulant)*
7 *Examination for general, nutritional & PARNUTS labelling*
8 *This survey was designed for Irish manufactured supplements but due to difficulty sourcing the required number of samples from Irish manufacturers,some non-Irish manufactured samples are also included (30 Irish out of 48 samples – 2015)*
9 *See Section 2.5.2 for details of non-compliances*
10 *See Table 2.10 for details of non-compliances*
11 *Survey targeted imported body building supplements only.*
Note: A national survey of market-level food supplements containing caffeine was also carried out in 2016. The analyses were performed in the Public Analysts' Labs in Cork and Dublin.

1,3-dimethylamylamine (DMAA), also known as geranamine, methylhexanamine or dimethylpentylamine, is a stimulant related to amphetamine and ephedrine. It may occur illegally in some food supplements marketed typically as performance-enhancing or fat-loss products. In April 2013, the U.S. FDA determined that DMAA was potentially dangerous and did not qualify as a legal dietary supplement; it warned supplements' manufacturers and consumers of potentially serious health risks associated with DMAA-containing products. An LC-MSMS method was used here to perform testing. No DMAA was found (<0.2 mg/kg) in any of the body-building samples (29 in 2015 and 28 in 2016) tested.

1,3-dimethylbutylamine (DMBA), is an amine related to 1,3-dimethylamylamine (DMAA). It is also known as 2-amino-4-methylpentane or AMP citrate, and it is considered as an unapproved stimulant. Following reports of the presence of DMBA in dietary supplements, testing was introduced here in 2014 (3 batches of a product were found to be adulterated at ca. 2-3 % by weight). None of the Imported Body-building Supplements tested in 2015 (29 samples), or in 2016 (27 samples), were found to be 'adulterated' with DMBA.

2.5.5.3 Folic-acid-only Supplements and Multi-vitamin Supplements etc.

- See under Section 2.5.2 Folic Acid above

2.6 Additives/Labelling/Compositional Quality Results 2015 and 2016 (see Table 2.12)

2.6.1 Additives

The choice of additives to be monitored is made by the HSE, in association with FSAI, on a year-to-year basis, depending on known usage, risk of exceedance of the acceptable daily intakes (ADIs), and risk/previous results history. The testing is performed to monitor for legislative compliance and also to collect data for the EU on actual food levels and dietary intakes. Testing for food additives has decreased in this laboratory over the years, as much of the testing is now performed as specialisations at other Public Analyst Labs (Cork and Dublin).

2.6.2 General Labelling

Regulation (EC) 1169/2011 on "the provision of food information to consumers" includes the introduction of certain new labelling requirements covering:

•compulsory nutritional labelling
•extension of country-of-origin labelling to meat other than bovine meat
•"distance" sales (i.e. internet sales) and to temporary advertising (e.g. chalk boards).
• food sold without pre-packaging (the presence of allergens…), - this is a major change in practice for food businesses and has required domestic legislation to define how this information is to be imparted, as well as how it is to be enforced in this country.

Regulation (EC) 1169/2011 is given effect in Ireland by S.I. No. 556 of 2014 for the 'general' labelling provisions in the EU regulation and by S.I. No. 489 of 2014 for the allergen labelling requirements of foods sold without pre-packaging; both of these pieces of legislation and their parent regulation came into effect on the 13th of December 2014.

In 2015, 315 samples were examined for compliance with labelling legislation and 143 were designated as being non-compliant. In 2016, 124 samples were examined for compliance with labelling legislation and 69 were designated as being non-compliant. The problems arise from a wide range of deficiencies, some particular ones include: 'ethnic' processed foods with the absence of labelling in English or Irish; format of nutritional panel information; format of allergen information; problems with nutritional and/or health claims; general issues with some small-bakery products; inaccurate labelled nutrient levels, etc.

Table 2.12 Summary of Additives/Labelling/Compositional/Quality Results 2015 & 2016

Parameter(s)	Food Types etc	Number of Samples Tested & Results 2015			Number of Samples Tested & Results 2016		
		Total	Complying with Standard	Non-Complying with Standard	Total	Complying with Standard	Non-Complying with Standard
Sulphur Dioxide	See details in Table 2.3, Food Allergens						
Nitrites & Nitrates[1]	Brines	13[2]	12[2]	0	7	7	0
Food Irradiation[3] Photo-stimulated luminescence screening	2015: Vitamins/Food supplements (41), Body building supplements (24), Miscellaneous (11) 2016: Food Supplements (11), Body Building Foods (17), Peanut butter (1)	76	75	1	29	29	0
General Labelling	Miscellaneous Packaged Foods	315	172	143	124	55	69
Ref Index/Soluble solids pH	Juices, sauces	24	24	0	26	26	0
Titratable Acidity (rancidity development during shelf life)	Milk	3	3	0	0	0	0
Total Fat	Minced Meat (complaint /suspect sample)	1	1	0	0	0	0
Vitamin D3 (2 private samples, out-contracted)	Food supplements	2	2	0	N/T	N/T	N/T

[1] Authorisation and limits are set in Annex II Part E of Regulation (EC) No 1333/2008 as amended by Regulation (EC) No. 1129/2011.
[2] 12 brines were found to be compliant (since the calculated ingoing amounts in the meats were all less than 150mg/kg (the legislative limits for the ingoing amounts of Sodium Nitrite & for Sodium Nitrate in meats)). One brine was "not designated" since the ingoing amount of Sodium Nitrite (166mg/kg) slightly exceeded 150mg/kg (however, taking the Measurement Uncertainty into account the limit may not be exceeded).
[3] S.I. 297 of 2000 authorises irradiation of herbs, spices and vegetable seasonings. Irradiated foods must be labelled as such. One sample of a food supplement was found to be irradiated by the screening analysis – this sample result was not designated.

2.6.3 Survey of Beers and Ciders from Irish Micro-breweries

Surveys of Beers and Ciders from Irish Microbreweries								
	2015				2016			
	No. Tested	Compliant	Non-compliant	Not Designated	No. Tested	Compliant	Non-compliant	Not Designated
Ethanol	26	23	0	3[1]	30	25	0	5[1]
Sulphur Dioxide	26	26	0	0	30	30	0	0
Labelling Examination	24	21	3	0	N/A	N/T	N/T	N/T

[1] These results were "Not designated", because although the alcohol level was slightly outside the tolerance (+/- 0.5% vol, or +/-1%vol depending on their labelled alcoholic strength) set in EU Regulation 1169/2011 (Annex XII) , the test method was not technically the same as that specified in the Regulation.

There has been a recent, large increase in the number of beers etc produced in Ireland by micro-breweries. In 2015 HSE introduced some surveillance of such products (tests initially include: alcohol content, sulphites, labelling and general examination). 26 samples were tested in 2015 and 30 in 2016. None of the beers samples contained quantifiable sulphites, and the sulphite levels detected in the cider samples were compliant with their limit. Most samples had compliant levels of alcohol (ethanol); 3 samples were designated as Non-compliant due to allergen labelling deficiencies.

2.7 Food Complaints

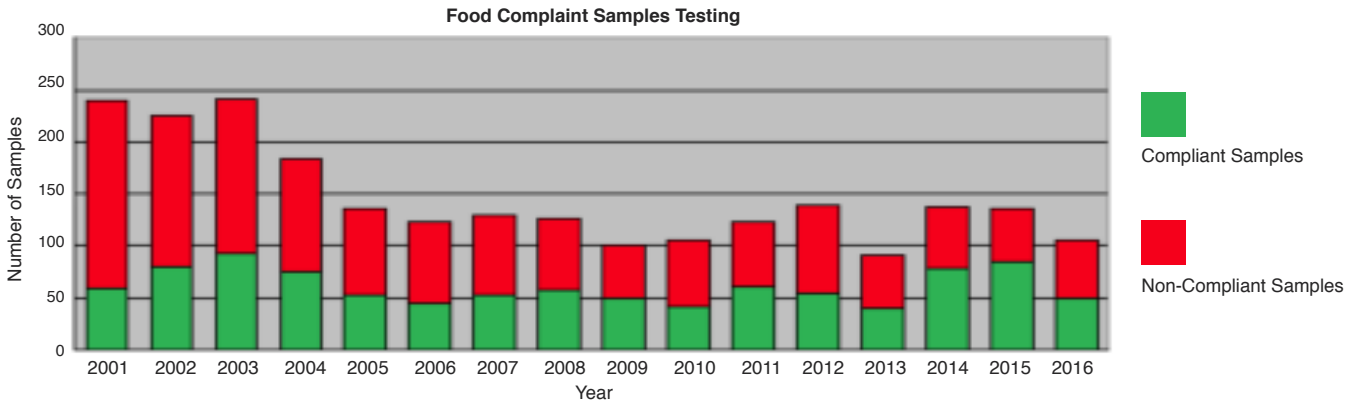
Complaint samples generally arise when consumers find contamination or other defects in foods. Complaints are made to the EHS, the FSAI or to the laboratory. Some complaints arise from food poisoning incidents (these samples are tested primarily in the Food Microbiology laboratories, but may also require chemical testing). Complaint samples analysed in this laboratory usually involve the presence of foreign bodies such as metal, plastic, insects etc, and also abnormal odours/tastes/appearance etc in food. A total of 136 complaint samples received from EHS (122) and directly from the public (14), was investigated here in 2015. Of the 136, the number of adverse reports issued was 52 (38%). In 2016, of a total of 105 received, 85 from the EHS and 20 directly from the public, 56 adverse reports were issued (53%).

Appendix 2 gives a breakdown of food complaints received, by food category, from the HSE Environmental Health Service. The number of food complaints received in this laboratory has decreased from an average of 222 per annum (2001-2004) to an average of 121 (2012 – 2016).

The reason for this reduction may be related to better handling of complaints by retailers, or to the fact that other bodies, e.g. FSAI now receive food complaints.

It is important to understand that the number of food complaints received here represents a very small fraction of the total number of food items consumed in our region.

Propylene glycol etc testing in Vodka and Wine. In 2016, 7 samples of vodka and 3 samples of wine were received for propylene glycol analysis, as part of a medical investigation, following the hospitalisation of two people. These samples were also screened for the presence of diethylene glycol and ethylene glycol. All 10 samples were found to be compliant. The results indicated that the received samples were not the source of the reported poisoning.



2.8 Food Alerts (RASFF) and Food Incident Notification Reports

The EU Rapid Alert System for Food and Feed (RASFF) is activated when a member state reports a significant contamination/risk/legislative issue associated with a batch of food or feed (animal feedstuffs). The EU RASFF Notifications Reports for 2015 and 2016 (preliminary report) is available on:

https://ec.europa.eu/food/sites/food/files/safety/docs/rasff_annual_report_2015.pdf
https://ec.europa.eu/food/sites/food/files/safety/docs/rasff_annual_report_2016.pdf

A summary of the RASFF notifications for 2015 and 2016 is given by hazard category groups below:

Hazard Category Group	Number of Notifications 2015
Chemical & Physical Hazards[1]	2,092
Microbiological Hazards[2]	842
Other Hazard / Risks[3]	142

Hazard Category Group	Number of Notifications 2016
Chemical & Physical Hazards[1]	2,122
Microbiological Hazards[2]	778
Other Hazard / Risks[3]	160

[1] Pesticide Residues, Mycotoxins, Heavy Metals, Compositional , Food Additives & Flavourings,Veterinary Residues, Foreign Bodies, Migratory Substances/FCMs, Adulteration/Fraud, GMOs/Novel Foods, Industrial Contaminants, Allergens, Biocontaminants/Biotoxins, Organoleptic defects, Ionising Radiation, feed additives, etc.

[2] Pathogenic Micro-organisms, TSEs, Parasites, Other Microbiological Contamination.

[3] Insufficient controls, Absent Labelling etc., Defective Packaging, Organoleptic defects, others.

Note: Of above Notifications, in 2015, 206 (ca. 7% of original notifications) concern animal feedstuffs while in 2016, 209 (ca. 8% of original notifications) concern animal feedstuffs.

The main parameter groups notified in EU in 2015 were (in decreasing order): Pathogenic Microorganisms, Mycotoxins, Pesticide Residues, Heavy Metals, Food Additives & Flavourings, Allergens, Compositional, Foreign bodies, Adulteration/Fraud, Poor or insufficient controls, Migration (from packaging), Non-pathogenic microorganisms, Veterinary Residues, Industrial contaminants, GMOs/Novel Foods, Biocontaminants /Biotoxins, Organoleptic aspects, all regular and recurring issues. In 2016, the main parameter groups notified were (in decreasing order): Pathogenic Microorganisms, Mycotoxins, Pesticide Residues, Heavy Metals, Composition, Food Additives & Flavourings, Foreign Bodies, Allergens, Adulteration/Fraud, Poor or insufficient controls, GMO/Novel food, Migration, Non-pathogenic microorganisms, Industrial contaminants, Veterinary residues, Biocontaminants/Biotoxins, Organoleptic defects, again all regular and recurring issues.

FSAI Incident Notifications are issued by the laboratory to the EHO service and the FSAI when a 'significant' contamination/hazard is detected. Upon assessment by FSAI, a Food Alert notification may be issued (to the EU) depending on their evaluation of risk. In 2015, 13 Food Incident Notification Reports were issued by the laboratory, relating to: excessive sulphur dioxide in peeled potatoes (1), non-permitted sulphur dioxide in chopped vegetables (1), chopped apple (3), and steak mince (1) undeclared sulphur dioxide in apricots (1), elevated histamine in mackerel (1), glass fragment in sugar (1), and milk protein in coconut milk (4). In 2016, no incident notifications were issued by the laboratory. Numbers of Food Incident Notification Reports issued from this laboratory are outlined below.

2016	0	2010	11
2015	13	2009	14
2014	15	2008	7
2013	12	2007	24
2012	12	2006	26
2011	11	2005	23

3. WATERS / EFFLUENTS

3.1 Introduction

Globally, water quality has an important impact on public health. Water of poor quality can cause disease outbreaks and it can contribute to background rates of disease manifesting themselves on different time scales.

In Ireland, the European Union (Drinking Water) Regulations 2014, S.I. 122 of 2014 assign the Environmental Protection Agency (EPA) the role of supervisory authority over public water supplies and provides powers of enforcement to ensure actions are taken where the quality of public drinking water is deficient. The EPA coordinates and oversees implementation of the Water Framework Directive, Directive 2000/60/EC (WFD). This directive has established a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater in one piece of environmental legislation. The objectives of the (WFD) are to protect all high status waters, prevent further deterioration of all waters and to restore degraded surface and ground waters to good status by December 2015. The second cycle of the WFD runs from 2015 to 2021. This cycle has three tiers. The first tier (National Management and Oversight) is led by the Department of the Environment, Community and Local Government. The second tier (National Technical Implementation and Reporting) is led by the EPA. The third tier (Regional Implementation via Water Networks) is led by the Local Authorities.

To ensure compliance with the relevant legislation, each water supply must be monitored on a regular basis. The monitoring frequency is legally set out in the regulations, and minimum monitoring frequencies for drinking water depend on the size/water output of the supply in question.

Drinking water safety comprises a number of different elements. The chemical aspects discussed in this report are one element. The other elements involved are microbial and radiological. Further information on all aspects of drinking water safety, including recently published guidance notes can be found on the EPA website at www.epa.ie. Drinking water results prior to 2014 are available on the EPA website, while results for 2014 onwards are available through the Irish Water website www.water.ie

The public health issues associated with chemical contamination of drinking water arise primarily from the ability of chemical constituents to cause adverse health effects after prolonged periods of exposure. There are few chemical constituents of water that can lead to health problems resulting from a single exposure, except through massive accidental contamination of a drinking water supply. Experience has shown that in many, but not all, such incidents, the water becomes undrinkable owing to the unacceptable taste, odour or appearance.

3.2 Drinking Water Management

The Water Services Act 2013 and the Water Services (No 2) Act 2013 transferred responsibility for the supply of water from over 1000 public water supplies from local authorities to Irish Water, the new national water services authority, from 1st January 2014. Currently, local authorities manage public water supplies on behalf of Irish Water. Further information on Irish water is available at www.water.ie

Irish Water is now responsible for the production, distribution and monitoring of drinking water for 82.0% of the population. The remainder of the population (18%) is supplied by group water schemes (6.6%), small private supplies (0.8%) and private wells (10.6%). Responsibility for the quality of water for this 18% of the population rests with the manager/operator of the supply, while monitoring these supplies remains the responsibility of the local authorities. Information on these and other drinking water issues (conservation etc.) can be found on the citizen's information website at www.citizensinformation.ie

3.3 2015 & 2016 Samples

3.3.1 Sample Sources

The laboratory received a total of 6,932 water samples in 2015. This number increased to 7,589 samples in 2016. This is primarily due to an increase in samples from private sources. In excess of 100,000 tests were carried out annually on these samples. Samples are received from a wide variety of sources, as shown in Table 3.1.

Table 3.1 Source of samples received in 2015 and 2016

Source	2015	2016
Galway (HSE)	393	622
Galway County Council	152	94
Galway City Council	632	387
Mayo	1,204	1,370
Roscommon	237	229
Donegal	1,759	1,735
Sligo/Leitrim	465	495
North Tipperary	471	468
Clare	223	190
Limerick	215	188
Haemodialysis (Hospitals)	422	392
Private	759	1,419
TOTAL	**6,932**	**7,589**

3.3.2 Sample Types

Various sample types are received in the laboratory. Most of the samples received are drinking waters, and are tested as audit (27 parameters), check (11 parameters) or volatile organic compounds (8 parameters) samples. They are tested for compliance with the European Union (Drinking Water) Regulations 2014, S.I. 122 of 2014. The laboratory carries out the official monitoring of public water supply fluoridation in the HSE West area (see section 3.5). Other sample types analysed are haemodialysis samples, bathing waters, pool waters and effluents (see sections 3.9 – 3.12 respectively). Along with carrying out audit and check analysis of bottled waters, the laboratory is the official laboratory for the analysis of volatile organic compounds in still bottled waters. Bottled waters are analysed for compliance with the European Communities (natural waters, spring waters, and other waters in bottles or containers) regulations 2007, S.I. 225 of 2007. The results of the bottled water analysis are discussed in detail in the food section of this report. A breakdown of all the analyses (excluding bottled waters) carried out in 2015 & 2016 is shown in Table 3.2.

Table 3.2 Analysis carried out in 2015 and 2016

Analysis	2015	2016
Audit	1,323	1,519
Check	2,679	2,594
VOC	811	1,275
Fluoride	1,108	1,190
Lead	142	33
Haemodialysis	422	392
Bathing Waters	89	90
Pool Waters	339	477
Effluents	19	19
TOTAL	**6,932**	**7,589**

3.4 Water Quality

The overall quality of drinking water can only be obtained by also considering the bacteriological and radiological quality along with additional chemical parameters. This information is published by the EPA.

The World Health Organisation (WHO) has published a Water Quality and Health Strategy, 2013-2020. This strategy has the principal aim of managing water quality, with a view to protecting and promoting human health.

The testing by this laboratory indicates, in general, a very high level of compliance for those parameters tested in public supplies, with two thirds of all non-compliant drinking water samples originating from private sources. In 2015, a total of 1889 exceedances were detected. 201 of these exceedances were due to elevated Trihalomethanes (THMs). As detailed in Table 3.6 and 3.7; 933 of these exceedances were due to metals, while the remaining 755 were non-metal exceedances. Analysis of these 1889 non compliances showed that approximately 62% of the exceedances originated from private sources. In 2016 this number decreases slightly to approximately 57%. Table 3.3 shows the level of non compliance over the last 5 years.

Table 3.3 Non compliant results issued by the laboratory over the last five years.

		2012	2013	2014	2015	2016
Total Exceedances		1,918	1,921	2,200	1,889	2,084
VOC	Non compliant results	214	250	174	201	299
	% Non-compliance	28	31	23	26	25
Non-metals	Non compliant results	722	731	1,123	755	766
	% Non-compliance	2	2	3	2	2
Metals	Non compliant results	982	940	903	933	1,019
	% Non-compliance	4	4	3	3	3

Based on scientific studies, the International agency for research on cancer (IARC) has classified water contaminants into 5 groups based on their carcinogenicity, as shown in Table 3.4. Results from IARC studies, along with relevant publications can be viewed on www.iarc.fr

The WHO takes the IARC classifications into consideration when determining guideline values for drinking water quality. Further information on the work carried out on drinking water quality by the WHO can be viewed on www.who.int

Table 3.4 Classification of water contaminants from the IARC

Group	Classification
1	Carcinogenic to humans
2A	Probably carcinogenic to humans
2B	Possibly carcinogenic to humans
3	Not classifiable as to its carcinogenicity to humans
4	Probably not carcinogenic to humans

3.5 Fluoridation of Public Water Supplies

Public water fluoridation was introduced into Ireland in July 1964, on the grounds of being a low-cost public health measure considered to be safe to human health and of benefit to all sections of society, and not restricted by social boundaries. Surveys have been conducted on a regular basis to measure the effectiveness of water fluoridation in the Republic of Ireland. These studies include: National Survey of Children's Dental Survey 1984; Regional Surveys of Children's Oral Health 1990-1999; National Survey of Adult's Oral Health 2001; an All-Island Survey of Children's Oral Health 2002 (which included a comparison with caries levels in Northern Ireland) and Cross-Border Study of impact of water fluoridation in 16 year olds, 2006. One of the more recent reviews was carried out in 2011 by the Scientific Committee on Health and Environmental Risks (SCHER) of the European Commission. They concluded that there was no link between fluoridation and any unwanted health effect. The Irish Expert Body on Fluorides and Health is of the opinion that there continues to be overwhelming evidence that water fluoridation significantly benefits dental health. The Expert Body is satisfied, having studied current peer reviewed scientific evidence worldwide, that water fluoridation, at the optimal level, does not cause any ill effects and continues to be safe and effective in protecting the oral health of all age groups. These views are supported by reputable international agencies and valid scientific articles and reviews. The Journal of the Irish Dental Association published a supplementary Fluoride article in June/July 2012, in which it looks back at 50 years of Fluoridation in Ireland.

In 1984, the WHO issued a guideline value of 1.5mg/L for fluoride in drinking water. This value was reaffirmed in 1993 and again in 2011. The WHO reports that more than 200 million people in 39 countries benefit from artificially fluoridated drinking water.

Currently, two separate pieces of legislation are applicable to the levels of fluoride in drinking water. The Fluoridation of Water Supplies Regulations 2007, S.I. No. 42 of 2007, specifies a concentration range of 0.6mg/L to 0.8mg/L Fluoride and the European Communities (Drinking Water) Regulations 2014, S.I. 122 of 2014 apply a Parametric Value of 0.8mg/L to drinking water supplies. These regulations also require that water supplies to which Fluoride has been added shall be monitored for Fluoride at intervals not exceeding one calendar month. In Ireland, Fluoride monitoring is carried out by the HSE. Further information can be accessed at www.hse.ie

This laboratory carries out the official monthly fluoride testing on all fluoridated supplies in the HSE-Western region. The results can be viewed in Appendix 5. In total, fluoride results were issued for 1095 samples in 2015, while the number increased to 1123 in 2016. In both 2015 and 2016, 12 samples were found to contain >0.8 mg/L Fluoride.

3.6 Non-Metals in drinking Water

The results for 2015 and 2016 are summarised in Table 3.5 and 3.6.

3.6.1 Volatile Organic Compounds (VOCs)

Disinfection is a critical part of drinking water treatment and is fundamental to preventing the spread of waterborne infectious diseases. The use of disinfectant chemicals can result in the formation of disinfection by-products (DBPs). Chlorination is the most common disinfection method used in Ireland and chlorine use is regulated primarily to minimise the formation of DBPs. One class of DBP are the Volatile Organic Compounds (VOCs). These compounds include Trihalomethanes (THMs), Benzene, 1,2 Dichloroethane, Trichloroethene and Tetrachloroethene. THMs (Chloroform, Bromodichloromethane, Dibromochloromethane and Bromoform) are not naturally occurring compounds, and are formed when chlorine (a strong oxidising agent) reacts with naturally occurring organic matter in raw water. There is a direct relationship between the degree of colour in water prior to chlorination and the concentration of THMs after chlorination.

While the DBPs mentioned above are dealt with in the 2014 Drinking Water Regulations (S.I. 122 of 2014), a further group of chlorine associated DBPs, haloacetic acids (HAAs), are of increasing concern but are not included in the 2014 drinking water regulations although they may well be included in future regulations.

As most water supplies in Ireland are surface water sources and some of our groundwater sources may be influenced by surface water, raw water is likely to contain high levels of particulate and organic matter. This can be much greater after heavy rainfall or flooding. THMs are formed when there is either inadequate pre-treatment of the water and/or poor control over the disinfection process itself. THM formation is dependent on several variables; the concentration and nature of the organic material in the raw water, chlorine contact time, the residual chlorine concentration in the water and the pH and temperature of the water. Optimum filtration and coagulation before disinfection is therefore important in preventing the formation of THMs.

Chlorine is used not only as a primary disinfectant in water treatment but is also added to provide a stable disinfectant residual to preserve the quality of the water throughout the distribution network. While this characteristic of chlorine makes it most suitable as a disinfectant it also means that it is more prone to DBP formation because it has more contact time with organic matter in the water that was not removed during treatment. Additional chlorine may be added in order to maintain an adequate residual concentration throughout the distribution system particularly at end points. Temperature and pH of drinking water vary across supplies and from season to season. Optimum control over all of these factors is necessary to keep THMs to a minimum.

Chloroform is the most common THM and the principal disinfection by-product in chlorinated drinking water. In the presence of bromides, brominated THMs are formed preferentially, and chloroform concentrations decrease proportionally.

Chloroform and Bromodichloromethane are classified as group 2B agents by the IARC. While Bromoform and Dibromochloromethane are classified as group 3 agents. The EU has set a health-based parametric value of 100µg/L for THMs (S.I. 122 of 2014). The WHO has issued guideline values of 300µg/L for Chloroform, 100µg/L for Bromoform, 100µg/L for Dibromochloromethane and 60µg/L for Bromodichloromethane.

A summary of results issued for 787 samples in 2015 and 1183 samples in 2016 is shown in the Table 3.5. The high level of non compliance for both years is mainly due to non compliant supplies being analysed repeatedly.

Table 3.5 Trihalomethane results 2015 and 2016

Trihalomethane Results (µg/L)					
Concentration Range	≤10	11-50	51-100	101-150	>150
2015	77	304	205	116	85
2016	130	434	320	171	128

Trichloroethene is used primarily in metal degreasing. It is emitted mainly to the atmosphere, but it may also be introduced into ground water and, to a lesser extent, surface water in industrial effluents. Poor handling and improper disposal of trichloroethene in landfills have been the main causes of ground water contamination. All 787 samples analysed in 2015 and all 1,176 samples analysed in 2016 were found to contain <2µg/L Trichloroethene.

Tetrachloroethene has been used primarily as a solvent in the dry cleaning industry and to a lesser extent as a degreasing solvent. It is widespread in the environment and is found in trace amounts in water, aquatic organisms, air, foodstuffs and human tissues. In anaerobic ground water tetrachloroethene may degrade to form more toxic compounds, including vinyl chloride. All 787 samples analysed in 2015 and all 1,176 samples analysed in 2016 were found to contain <2µg/L Tetrachloroethene.

1,2 Dichloroethane is used mainly as an intermediate in the production of vinyl chloride and other organic chemicals. All 787 samples analysed in 2015 and all 1,150 samples analysed in 2016 were found to contain <1µg/L.

Benzene is present in petrol, and vehicular emissions constitute the main source of benzene in the environment. Benzene may be introduced in drinking water by industrial effluents and atmospheric pollution. Benzene is principally used in the production of other organic chemicals. While waterborne and foodborne benzene contributes only a small percentage of the total daily intake in non-smoking adults, all possible precautions should be taken to limit benzene concentration in drinking water. 785 out of the 786 samples analysed in 2015 and all 1180 samples analysed in 2016 were found to contain <1.0µg/L Benzene. In 2015, the one sample which exceeded the limit was found to contain 2.0µg/L Benzene. The results for these parameters can be viewed in Table 3.6. Benzene has been identified by the WHO as one of the top 10 chemicals of public health concern. The WHO has issued separate guidelines on benzene as part of their international programme on chemical safety. Further information is available on www.who.int

3.6.2 Ammonium

Ammonium (NH_4^+) and ammonia (NH_3) are in equilibrium in an aqueous environment. The prevalence of each is dependent on pH and temperature. Above pH 9, the more toxic ammonia begins to form. At pH 8, the ammonia concentration is approximately 10%, while the relatively non toxic ammonium accounts for the other 90%.

Ammonia is a colourless, pungent gaseous compound that is highly soluble in water. In the environment, it originates from metabolic, agricultural and industrial processes and from disinfection with chloramines. Natural levels in both groundwater and surface water are generally below 0.1mg/L. The EU has set a parametric value of 0.50mg/L in drinking water. However, a stricter limit of 0.30mg/L is set in Irish Legislation (S.I. 122 of 2014). Ammonia levels greater than the parametric value may be an indicator of possible bacterial, sewage and animal waste pollution. The threshold odour concentration of ammonia at alkaline pH is approximately 1.5mg/L. The WHO has not issued a health-based guideline value for ammonia in drinking water, as toxicological effects are only observed at exposures above 200mg/kg body weight. However, ammonia can compromise disinfection efficiency, result in nitrite formation in distribution systems, cause the failure of filters for the removal of manganese and cause taste and odour problems. It should be pointed out that over half the samples analysed for ammonium in both 2015 and 2016 were found to contain ⩽0.03mg/L ammonium. It should be pointed out that the vast majority of non compliant samples in both 2015 and 2016 were from private sources.

3.6.3 Chloride

Chloride in drinking water originates from natural sources, sewage, industrial effluents and artificially softened waters. The main source of human exposure to chloride is the addition of salt to food. The WHO has not issued a guideline value for chloride in drinking water, as the concentrations found are not of health concern; however S.I. 122 of 2014 sets a parametric value of 250mg/L for chloride in drinking water. Above this level, chloride may give rise to detectable taste in water. In 2015, 14 exceedances were found, with 10 of these coming from private sources. In 2016, 26 exceedances were found, with 20 of these coming from private sources.

3.6.4 Chlorine

Chlorine is the most widely used disinfectant for the inactivation of water borne pathogens in drinking water supplies and historically has arguably made the greatest contribution to the public health protection of consumers. The use of chlorine has virtually eliminated waterborne diseases such as cholera, typhoid and dysentery.

Chlorine is used as both a primary disinfectant in water treatment and is also added to provide disinfection residual to preserve water in the distribution network.

Chlorination of drinking water also has the benefits of eliminating slime bacteria, moulds and algae that commonly grow in water supply reservoirs, on the walls of water mains and in storage tanks.

The EPA first published a Water Treatment Manual on Disinfection in 1998. This was revised and reissued in 2011. This publication contains information on the various methods of disinfection, along with the advantages and limitations of the different methodologies.

The WHO has published detailed information on the formation of DBPs in drinking water and while they recommend that DBP levels in drinking-water be kept as low as practicable (see section 3.6.1), it emphasizes that the microbial safety of drinking-water should never be compromised and effective disinfection to prevent waterborne infectious diseases must take precedence over efforts to meet DBP legislative limits.

There is no statutory limit for the levels of chlorine in drinking water, but the level of residual chlorine present at the consumers tap is constrained between being acceptable to consumers and still providing disinfection. In 2015, 956 samples were found to have an odour of chlorine, and were subsequently analysed for residual chlorine levels. While 16 samples were found to contain >1.0mg/L free chlorine, only 1 of these samples (from a private source) was found to be in breach of the WHO guideline value of 5.0mg/L chlorine. 67 of these samples were also analysed for total chlorine. All 67 samples were found to contain <0.5 mg/L chlorine.

In 2016, 763 samples were found to have an odour of chlorine, and were subsequently analysed for residual chlorine levels. While 13 samples were found to contain >1.0mg/L free chlorine, 4 of these samples were found to be in breach of the WHO guideline value of 5.0mg/L chlorine. 48 of these samples were also analysed for total chlorine. With the exception of 1 private sample, all samples were found to contain <0.5 mg/L chlorine.

3.6.5 Colour

Ideally, drinking water should have no visible colour. Colour in drinking water is usually due to the presence of coloured organic matter (primarily humic and fulvic acids) associated with the humus fraction of soil. It is also strongly influenced by the presence of iron and other metals. There is no WHO health-based guideline value for colour, although a level of 20mg/L Pt-Co, is generally used. As discussed previously (see section 3.6.1), a direct relationship exists between the degree of colour in water prior to chlorination and the concentration of THMs after chlorination. In essence, colour is essentially an aesthetic parameter, but it may indicate other problems in chlorinated supplies.

The predominant mechanism for removal of dissolved coloured substances such as humic and fulvic acids is the coagulation/sedimentation process. Removal of organic material by coagulation with aluminum and iron salts has been shown to be effective. In high colour raw waters, the initial point of chlorine application should follow the coagulation/sedimentation process in order to lower the levels of DBPs in the final water. The results for 2015 and 2016 are detailed in Table 3.6.

3.6.6 Conductivity/Total Dissolved Solids (TDS)

Conductivity is the ability of a solution to conduct electric current. It is the reciprocal of electrical resistivity. Therefore, conductivity is a measure of the dissolved solids which have been ionised in the water. Total dissolved solids (TDS) comprise of inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulphates) and small amounts of organic matter that are dissolved in the water. The conductivity of a drinking water is also affected by temperature: the higher the temperature, the higher the conductivity.

Drinking water becomes significantly and increasingly unpalatable at TDS levels greater than 1,000mg/L. This corresponds to a conductivity of approximately 1250µS/cm. In 2015, 14 samples (all from private sources) had conductivity levels in excess of 1250µS/cm, with 1 of these samples also in excess of the EU limit of 2500µS/cm.

In 2016, 27 samples had conductivity levels in excess of 1250µS/cm, with 26 of these samples coming from private sources. 4 of these samples (all from private sources) were also found to be in excess of the EU limit of 2500µS/cm.

3.6.7 Hardness/Calcium Hardness

Hardness in drinking water is caused by a variety of dissolved polyvalent metallic ions, predominantly calcium and magnesium cations, although other cations (e.g. aluminium, barium, iron, manganese, strontium and zinc) also contribute. Calcium and magnesium are essential minerals and are hugely beneficial for human growth and development.

Hardness is usually indicated by precipitation of soap scum and the need for excess use of soap to achieve cleaning. Public acceptance of the degree of hardness of water may vary considerably from one community to another. Depending on the interaction of other factors, such as pH and alkalinity, water with hardness above approximately 200mg/L may cause scale deposition in the treatment works, distribution system and tanks within buildings.

773 out of the 1,910 samples tested here in 2015 contained >200mg/L $CaCO_3$, with 61 (53 from private sources) containing >400mg/L $CaCO_3$. On the other hand, soft water (but not necessarily cation exchanged softened water) with a hardness of less than 100mg/L may have a low buffering capacity and thus be more corrosive for water pipes. 559 samples were found to contain <50mg/L $CaCO_3$.

731 out of the 1,952 samples tested here in 2016 contained >200mg/L $CaCO_3$, with 70 (61 from private sources) containing >400mg/L $CaCO_3$. 591 samples were found to contain <50mg/L $CaCO_3$.

Calcium hardness is a term for the level of calcium carbonate in water. It is used in the calculation of the Langelier Index. This is an index used to determine if a water sample has a tendency to dissolve or deposit calcium carbonate. Strictly speaking, it is not a corrosion predictor. There is no corrosion prediction index that applies to all materials, and in fact indices related to calcium carbonate saturation, have given mixed results. In particular, it should be noted that the Langelier Index is not considered a good corrosion prediction model for copper systems. The calcium hardness results for 2015 ranged from <10 to 1,100mg/L $CaCO_3$, while the results for 2016 ranged from 38 to 307mg/L $CaCO_3$.

3.6.8 Nitrate and Nitrite

Nitrate and nitrite are naturally occurring ions that are part of the nitrogen cycle. The nitrate concentration in both groundwater and surface water is normally low, but can reach high levels as a result of leaching or run-off from agricultural land, contamination from human or animal wastes as a consequence of the oxidation of ammonia or the erosion of natural deposits. Nitrite is the intermediate in the oxidation of ammonia to nitrate, and so any water containing appreciable levels of nitrite is of questionable quality.

The toxicity of nitrate to humans is mainly attributable to its reduction to nitrite. The major biological effect of nitrite in humans is its involvement in the oxidation of normal haemoglobin to methaemoglobin, which is unable to transport oxygen to the tissues, leading to methaemoglobinaemia.

In general, the most important source of human exposure to nitrate and nitrite is through vegetables (nitrate and nitrite) and through meat in the diet (nitrite is used as a preservative in many cured meats). In the case of bottle fed infants, drinking water can be the major external source of exposure to both nitrate and nitrite.

2,181 out of the 3,662 samples analysed in 2015 were found to contain <2.0mg/L nitrate and 3,512 out of the 3,667 samples analysed were found to contain <0.02mg/L nitrite. In 2015, the 18 samples with nitrate exceedances and the 11 samples with nitrite exceedances were all from private sources.

2,197 out of the 3,568 samples analysed in 2016 were found to contain <2.0mg/L nitrate and 3,207 out of the 3,564 samples analysed were found to contain <0.02mg/L nitrite. In 2016, the 3 samples with nitrate exceedances and the 4 samples with nitrite exceedances were all from private sources.

3.6.9 Odour

To a large extent, consumers have no means of judging the safety of their drinking water themselves, but their attitude towards their water will be affected to a large extent by the aspects of water quality that they are able to perceive with their own sense (taste, odour and appearance). The provision of drinking water that is not only safe, but also acceptable in appearance, taste and odour is of high

priority. Water that is aesthetically unacceptable will undermine the confidence of consumers, will lead to complaints and more importantly, could lead to the use of water from sources that are less safe. In most cases, aesthetic problems can be prevented by optimizing conventional treatment processes such as coagulation, sedimentation and chlorination.

The taste and odour thresholds of hydrogen sulphide in water are estimated to be between 0.05 and 0.1mg/L. The "rotten eggs" odour of hydrogen sulphide is a result of oxygen depletion and the subsequent reduction of sulphate by bacterial activity. Hydrogen sulphide in drinking water can be removed by techniques like aeration, granular activated carbon, filtration and oxidation. As it is unlikely that a person could consume a harmful dose of hydrogen sulphide from drinking water, the WHO has not issued a health-based guideline value for hydrogen sulphide in drinking water.

In 2015, 3651 samples were analysed for odour. 95 of these samples were found to exude an odour other than chlorine. The odours were categorised as follows: Objectionable (47), Hydrogen sulphide (19), Sulphur (9), Musty (13), Sweet (4), Hydrocarbon (2) and Phenol (1).
In 2016, 3524 samples were analysed for odour. 134 of these samples were found to exude an odour other than chlorine. The odours were categorised as follows: Objectionable (52), Hydrogen sulphide (21), Sulphur (13), Musty (37), Sweet (5), Earthy (2), Hydrocarbon (1) and Phenol (3).

3.6.10 pH (Hydrogen Ion Concentration)

The pH of water is a measure of the acid–base equilibrium. In most waters, pH is controlled by the carbon dioxide–bicarbonate–carbonate equilibrium system. Although pH usually has no direct impact on consumers, it is one of the most important operational water quality parameters. Careful attention to pH control is necessary at all stages of water treatment to ensure satisfactory water clarification and disinfection. For effective disinfection with chlorine, the pH should preferably be less than 8.0, although waters with a pH less than 7.0 are more likely to be corrosive. To comply with the regulations, drinking water should have a pH between 6.5 and 9.5. In 2015, 137 samples were non-compliant with respect to pH. 132 of these were found to have a pH < 6.5, with 105 of these samples being from private sources. 4 of the 5 samples with pH values >9.5 were private samples.

In 2016, 118 samples were non-compliant with respect to pH. 106 of these were found to have a pH < 6.5, with 81 of these samples being from private sources. 11 of the 12 samples with pH values >9.5 were private samples.

The installation of domestic reverse osmosis systems over the last number of years has lead to an increase in the number drinking water samples with pH values <6.5. This is due to the complex relationship between carbon dioxide, bicarbonate and carbonate in drinking water. At low pH values, carbon dioxide is the predominant species. At normal pH values, bicarbonate is the predominant species, while at high pH values, the predominant species is carbonate. Passing water through a reverse osmosis membrane removes both the bicarbonate and carbonate, but not the carbon dioxide, as this is a dissolved gas in the water. The presence of this carbon dioxide in the final water leads to a drop in the pH. The size of the pH drop generally depends on the amount of carbon dioxide in the mains water.

3.6.11 Sulphate

Sulphates occur naturally in numerous minerals and are used extensively in the chemical industry. Sulfates and sulfuric acid products are used in the production of fertilizers, chemicals, dyes, glass, paper, soaps, textiles, fungicides and insecticides. They are also used in the mining, wood pulp, metal and plating industries, in sewage treatment and in leather processing. Aluminium sulfate (alum) is widely used as a sedimentation agent in the treatment of drinking water. Sulphates are discharged into water in industrial wastes and through atmospheric deposition; however, the highest levels usually occur in ground water and are from natural sources.

The presence of elevated sulphate levels in drinking water can cause noticeable taste, and very high levels can cause a laxative effect in unaccustomed consumers. The taste threshold for sulphate in drinking water ranges from approximately 250mg/L for sodium sulphate to 1,000mg/L for calcium sulphate.

The WHO has not issued a health-based guideline value for sulphate in drinking water, as the levels found in drinking water are not of health concern. However, due to gastro-intestinal effects resulting from ingestion of high sulphate containing water, the WHO recommend that health authorities be notified of sources of drinking water containing more than 500mg/L sulphate. 7 of the 1912

samples analysed in 2015 and 5 of the 1944 samples analysed in 2016 were found to be in breach of the EU Parametric Value of 250mg/L sulphate.

3.6.12 Total Alkalinity

Alkalinity is a measure of the capacity of water or any solution to neutralize or "buffer" acids. This measure of acid-neutralizing capacity is important in figuring out how "buffered" the water is against sudden changes in pH.

Alkalinity should not be confused with pH. pH is a measure of the hydrogen ion (H^+) concentration, and the pH scale shows the intensity of the acidic or basic character of a solution at a given temperature. The reason alkalinity is sometimes confused with pH is because the term alkaline is used to describe pH conditions greater than 7 (basic). The most important compounds in water that determine alkalinity include the carbonate and bicarbonate ions. Carbonate ions are able to react with and neutralize 2 hydrogen ions and the bicarbonate ions are able to neutralize H^+ or hydroxide ions present in water. The ability to resist changes in pH by neutralizing acids or bases is called buffering. Alkalinity is especially important in areas where acid rain is a problem.

1,941 samples were analysed in 2015. The results ranged from <10 to 911mg $CaCO_3$/L. 24 samples (23 from private sources) were found to contain >400mg $CaCO_3$/L, while 333 samples were found to contain <50mg $CaCO_3$/L.

1,954 samples were analysed in 2016. The results ranged from <10 to 565mg $CaCO_3$/L. 161 samples (131 from private sources) were found to contain >400mg $CaCO_3$/L, while 330 samples were found to contain <50mg $CaCO_3$/L.

Table 3.6 Summary of Non-Metals in drinking water results for 2015 and 2016

Parameter	IARC Rating	Parametric Value (S.I. 122 of 2014)	WHO Guideline Value	2015 Samples Analysed	2015 Exceedances	2016 Samples Analysed	2016 Exceedances
Benzene	Group 1	1.0 µg/L	10 µg/L	786	1	1,180	0
Trichloroethene	Group 2A	10 µg/L	20 µg/L				
Tetrachloroethene			40 µg/L	787	0	1,176	0
1,2 Dichloroethane	Group 2B	3.0 µg/L	30 µg/L	787	0	1,150	0
Odour	n/a	Acceptable to consumers and no abnormal change	Acceptable to consumers	3,651	[1]95	3,524	[1]134
Colour	n/a			3,654	[2]167	3,543	[2]179
Turbidity	n/a			3,658	[2]198	3,543	[2]194
pH	n/a	6.5 – 9.5	-[4]	3,651	137	3,541	118
Conductivity	n/a	2,500 µS/cm		3,798	1	3,673	4
Nitrate	n/a	50 mg/L	50 mg/L	3,662	18	3,568	3
Nitrite	n/a	0.50 mg/L	3.0 mg/L	3,667	11	3,564	4
Ammonium	n/a	0.30 mg/L	-[4]	3,671	93	3,570	82
Free Chlorine	Group 3[3]	-	5.0 mg/L	956	[5]1	779	[5]4
Total Chlorine	Group 3[3]	-	5.0 mg/L	67	[5]0	48	[5]1
Chloride	n/a	250 mg/L	-[4]	1,909	14	1,943	26
Total Hardness	n/a	-	-[4]	1,910	n/a	1,952	n/a
Calcium Hardness	n/a	-		13	n/a	11	n/a
Total Alkalinity	n/a	-	-[4]	1,941	n/a	1,954	n/a
Sulphate	n/a	250 mg/L	-[4]	1,912	7	1,944	5
Fluoride		0.6 – 0.8 mg/L		1,095	[6]12	1,123	[6]12

[1] The number of samples not having chlorine or none detected as their odour.
[2] Although there are no health-based guideline values for colour or turbidity, levels of 20mg/L Pt-Co and 4.0 NTU respectively are generally used as guideline values.
[3] This classification refers to hypochlorite (one of the breakdown products of chlorine)
[4] Guideline value not established as the levels found in drinking water are not of health concern.
[5] The number of samples having in excess of 5mg/L free or total chlorine.
[6] The number of samples containing > 0.8 mg/L Fluoride.

3.6.13 Turbidity

In essence, turbidity is a measure of the relative clarity of water. Turbidity in water is caused by the presence of suspended particles or colloidal matter. Turbidity is not a direct measure of suspended particles in water but is a measure of the scattering effect such particles have on a light beam passed through the water.

Turbidity can seriously interfere with the efficiency of disinfection by providing protection for organisms, and much of water treatment is directed at removal of particulate matter before disinfection. Turbidity is measured in nephelometric turbidity units (NTU) and can generally be noticed by the naked eye above 4 NTU. However, to ensure the effectiveness of disinfection, turbidity should be no more than 1 NTU and preferably much lower. Of particular importance is the fact that this will be a good indicator that chlorine-resistant pathogens such as Cryptosporidium are being removed.

The vast majority of non compliant samples in both 2015 and 2016 were from private sources.

3.7 Metals in Drinking Water

The results for 2015 and 2016 are summarised in Table 3.7.

3.7.1 Aluminium

Aluminium is the most abundant metallic element and constitutes about 8% of Earth's crust. It occurs naturally in the environment as silicates, oxides and hydroxides, combined with other elements, such as sodium and fluoride, and as complexes with organic matter.

Aluminium salts are widely used in water treatment plants as coagulants to reduce organic matter, colour, turbidity, and microorganism levels. The process usually consists of addition of an aluminium salt (often sulphate) at optimum pH and dosage, followed by flocculation, sedimentation and filtration. The aluminium is subsequently removed, but traces may persist in the treated water. Aluminum is a non-essential trace element with no known biological function. The parametric value of 200µg/L in treated water is not a health based value, but prevents the deterioration of water quality (turbidity and colour) in the distribution network due to the deposition of aluminium hydroxides. The contribution of drinking water to the total oral exposure to aluminium is usually less than 5%. Currently, there are uncertainties as to the extent of aluminium absorption from drinking water, which depends on a number of parameters, such as the aluminium salt administered, pH (for aluminium speciation and solubility), along with dietary factors. The results for 2015 and 2016 are summarised in Table 3.7.

3.7.2 Antimony

Elemental antimony forms very hard alloys with copper, lead and tin and is often used in solders as a replacement for lead. It is also found in batteries, pigments, and ceramics/glass. The most widely used antimony compound is antimony trioxide, used as a flame retardant. Total exposure from environmental sources, food and drinking water is very low compared with occupational exposure. The chemical properties and toxicity of antimony are similar to those of arsenic.

9 of the 10 non-compliant samples analysed in 2015 were from private sources, with 1 of these samples also non compliant with respect to the WHO guideline value of 20µg/L. 1,144 samples were found to contain <1µg/L Antimony. In 2016, 3 of the 4 non compliant samples were from private sources, with 1376 samples found to contain <1µg/L Antimony.

3.7.3 Arsenic

Arsenic and inorganic arsenic compounds are principally used as alloying agents in the manufacture of transistors, lasers and semi-conductors. Arsenic occurs in both inorganic and organic forms. Inorganic arsenic compounds (such as those found in water) are highly toxic while organic arsenic compounds (such as those found in seafood) are less harmful to health. To date, arsenic has not been shown to be essential in humans and its' acute toxicity is predominantly a function of the rate of removal from the body. Long-term exposure to arsenic from drinking-water and food can cause cancer and skin lesions. It has also been associated with developmental effects, cardiovascular disease, neurotoxicity and diabetes. Arsenic is usually present in natural waters at concentrations of less than 1–2µg/L. However, in some waters, where there are sulphide mineral deposits and sedimentary deposits deriving from volcanic rocks, the concentrations can be significantly elevated. The results for the 2015 and 2016 are summarised in Table 3.7. It should be pointed out that 35 of the 36 exceedances

reported in 2015 and 54 of the 60 exceedances reported in 2016 were from private samples.

As with benzene, arsenic has also been classed by the WHO as one of the top 10 chemicals of public health concern. The WHO further state that water contaminated with arsenic, used for drinking, food preparation and irrigation of food crops poses the greatest threat to public health from arsenic.

The WHO has issued separate guidelines on arsenic as part of their international programme on chemical safety. Further information is available on www.who.int

3.7.4 Boron

Boron compounds are used in the manufacture of glass, soaps, detergents and flame retardants. Naturally occurring boron is present in groundwater, primarily as a result of leaching from rocks and soils containing borates and borosilicates. The borate content of surface water is frequently a consequence of the discharge of treated sewage effluent, arising from its use in some detergents. In 2015 and 2016, a total of 10 samples exceeded the EU Parametric Value (Table 3.7). All 10 samples were from private sources. In 2011, the WHO revised the Boron Guideline Value from 1.0mg/L to 2.4mg/L in drinking water. 3 of the non-compliant samples were also non-compliant with respect to the WHO guideline value.

3.7.5 Cadmium and cadmium compounds

Cadmium and cadmium compounds have a variety of industrial uses, including their use in solders, dental amalgams, batteries, nuclear reactors, television and computer monitor screens, photographic applications and fertilisers. Elemental cadmium is insoluble in water, while the solubility of cadmium salts is compound specific. Cadmium is released to the environment in wastewater, and diffuse pollution is caused by contamination from fertilizers and local air pollution. Contamination in drinking water can also be caused by impurities in the zinc of galvanized pipes and solders and some metal fittings or from erosion from mineral deposits.

In 2015 and 2016, all samples were compliant with respect to the EU Parametric Value (5µg/L), but 1 sample from each year (both from private sources) was non compliant with respect to the WHO guideline value (3µg/L). Over 99% of the samples analysed in both 2015 and 2016 were found to contain <1µg/L Cadmium.

As with benzene and arsenic, cadmium has also been classed by the WHO as one of the top 10 chemicals of public health concern. The WHO has issued separate guidelines on Cadmium as part of their international programme on chemical safety. Further information is available on www.who.int

3.7.6 Chromium

Chromium is widely distributed in the earth's crust. It has found a wide range of applications, mainly due to its hardness and resistance to corrosion. It is also known for its remarkable magnetic property. It is mainly used in the manufacture of stainless steel, as it prevents corrosion and discoloration of steel.

Biologically, chromium (III) or trivalent chromium is required by the human body. It is mainly required for carrying out lipid and sugar metabolism. Chromium (III) is found in bread, cereals, fish and vegetables. Chromium (VI) or hexavalent chromium is carcinogenic, and has been classified as a class 1 carcinogen by the IARC. Chromium (VI) is generally considered to be 1,000 times more toxic than Chromium (III).

Chromium is rarely found in natural waters at levels above 2µg/L. Its presence in water is generally the result of industrial and domestic chromium waste discharges or from contaminated land.

1 sample form both 2015 and 2016 were found to be non-compliant with regard to chromium levels. 95 % of all samples analysed for chromium in 2015 and 2016 were found to contain <4µg/L Chromium.

3.7.7 Copper

Copper is an essential human nutrient. Copper and copper compounds are widely used in the environment and are found in pipes, valves and fittings, fungicides, algicides, insecticides, wood preservatives and in electroplating. Copper compounds are also found in fertilizers and animal feeds, where they have a role as a nutrient to support plant and animal growth.

Copper concentrations in drinking water vary widely, with the primary source most often being the corrosion of interior copper plumbing. This corrosion is greater

when the water is acidic or very soft. Copper can stain laundry and sanitary ware at concentrations above 1mg/L. Although copper can give rise to a taste in water, it should be acceptable at the WHO health-based guideline value of 2.0mg/L. 67% of the samples analysed in both 2015 and 2016 were found to contain ⩽0.04mg/L copper.

3.7.8 Iron

Iron is the second most abundant metal in the earth's crust, and is an essential element in human nutrition. Elemental iron is rarely found in nature, as the iron ions Fe^{2+} (ferrous) and Fe^{3+} (ferric) readily combine with oxygen- and sulphur-containing compounds to form oxides, hydroxides, carbonates, and sulphides. In drinking water supplies, ferrous salts are unstable and are precipitated as insoluble ferric hydroxide, which settles out as a rust-coloured silt. Anaerobic groundwater may contain ferrous iron at concentrations of up to several milligrams per litre without discoloration or turbidity in the water when directly pumped from a well. Staining of laundry and plumbing fixtures may occur at concentrations above 300µg/L. Iron also promotes the growth of "iron bacteria", which derive their energy from the oxidation of ferrous iron to ferric iron and in the process deposit a slimy coating on the piping. Iron (particularly ferrous iron) is an essential element in human nutrition. The presence of iron in drinking water is primarily an aesthetic issue, with the WHO not issuing a guideline value for iron in drinking water, as the levels generally found are not of concern to human health.

In 2015, 308 samples were found to be non-compliant with regard to iron levels. 89 of these samples contained >1,000µg/L, and indeed 10 of these samples contained >10,000µg/L iron. 207 of the non-complying samples were from private sources.

In 2016, 334 samples were found to be non-compliant with regard to iron levels. 125 of these samples contained >1,000µg/L, and 22 of these samples contained >10,000µg/L iron. 238 of the non-complying samples were from private sources.

3.7.9 Lead

Lead is used primarily in the production of lead-acid batteries, solders and alloys. Lead affects the developing nervous systems and intellectual and behavioural developments. Consequently, foetuses and children under six years of age are most at risk.

Owing to the decreasing use of lead-containing additives in petrol worldwide and of lead-containing solder in the food processing industry, concentrations of lead in the air and food are declining, and intake from drinking water constitutes a greater proportion of total intake. Lead is rarely present in water as a result of dissolution from natural sources. Its presence is primarily due to household plumbing systems containing lead in pipes, solder, fittings or the service connection to homes. The amount of lead dissolved from the plumbing system depends on several factors, including pH, temperature, water hardness and the standing time of water in the pipes.

The HSE have a Frequently Asked Questions (FAQ) section regarding lead on their website. It deals with issues like how to identify the presence of lead piping, to testing your water for lead, to where to go to receive further advice. Lead (Pb) in Drinking Water, a position paper has been jointly developed by the Health Service Executive (HSE) and the Environmental Protection Agency (EPA). It was issued in December 2013 and provides a summary of the issues in relation to lead in drinking water including health, legislation and interventions. The full document is available at http://www.epa.ie/pubs/advice/drinkingwater/leadpositionpaper.html

113 samples analysed in 2015 were non-compliant, with 20 samples found to contain >50µg/L lead. 1,346 of the samples analysed in 2015 were found to contain <4µg/L lead.

In 2016, 54 samples were non-compliant, with 11 of these found to contain >50µg/L lead. 1,474 of the samples analysed in 2016 were found to contain <4µg/L lead.

It has been estimated that lead exposure was responsible, in 2004, for 143,000 deaths and 0.6% of the global burden of disease (expressed in disability-adjusted life years), taking into account mild mental retardation and cardiovascular outcomes resulting from exposure to lead. Lead in the body is distributed to the brain, liver, kidney and bones. It is stored in the teeth and bones, where it accumulates over time. Human

exposure can be assessed directly through measurement of lead in blood, teeth or bones.

As mentioned previously with benzene, arsenic and cadmium, Lead is also classed by the WHO as one of the top 10 chemicals of public health concern. The WHO has issued a comprehensive fact sheet regarding exposure to lead. Further information is available on the WHO website.

In 2016, the Domestic Lead Remediation (Financial Assistance) Regulations 2016 (S.I. No. 56 of 2016) was enacted. This legislation provides for homeowners to receive grant aid (subject to their income) to replace internal lead plumbing.

3.7.10 Manganese

Manganese is one of the most abundant metals in the earth's crust, usually occurring with iron. It is an essential element for humans and other animals. Adverse health effects can be caused by inadequate intake or over exposure. The main exposure of humans to manganese is from ingestion of food. Manganese is essential to the proper functioning of both humans and other animals as it is required by many cellular enzymes, and can serve to activate many others.

The major uses of manganese include steel production, and as an oxidant for cleaning, bleaching and disinfection (as potassium permanganate). It can also be used as an additive in unleaded petrol, to increase the octane rating and reduce engine knocking. At levels above 100µg/L, manganese in water supplies causes an undesirable taste in beverages and stains sanitary ware and laundry. When manganese (II) compounds in solution undergo oxidation, manganese is precipitated, resulting in encrustation problems. At concentrations as low as 20µg/l, manganese can form coatings on water pipes that may later slough off as a black precipitate.

Although the WHO have not issued a guideline value for manganese, as the levels found in drinking water are generally not of health concern, a health-based guideline value of 400µg/L has been derived.

In 2015, 253 samples were found to exceed the EU parametric value of 50µg/L manganese, with 212 of these coming from private sources. 73 samples were found to contain manganese levels exceeding the WHO health-based guideline value of 400µg/L, with 64 of these coming from private sources. 29 samples were also found to contain >1,000µg/L manganese, with 27 of these coming from private sources.

In 2016, 257 samples were found to exceed the EU parametric value of 50µg/L manganese, with 217 of these coming from private sources. 81 samples were found to contain manganese levels exceeding the WHO health-based guideline value of 400µg/L, with 69 of these coming from private sources. 35 samples were also found to contain >1,000µg/L manganese, with 32 of these coming from private sources.

3.7.11 Nickel

Nickel is used mainly in the production of stainless steel and nickel alloys. Food is the dominant source of nickel exposure in the non-smoking, non-occupationally exposed population. Nickel is an essential metal for human development, although its metabolism is not fully clear.

The primary source of nickel in drinking-water is leaching from metals in contact with drinking water, such as pipes and fittings. However, nickel may also be present in some ground waters as a consequence of dissolution from nickel ore-bearing rocks.

Allergic contact dermatitis is the most prevalent effect of nickel in the general population.

In 2015, 911 samples contained <4µg/L. 34 samples exceeded the EU parametric value of 20µg/L, with 6 of these samples also exceeding the WHO guideline value of 70µg/L.

In 2016, 1,071 samples contained <4µg/L. 43 samples exceeded the EU parametric value of 20µg/L, with 10 of these samples also exceeding the WHO guideline value of 70µg/L.

3.7.12 Potassium

Potassium is an essential element and is present in all animal and plant tissues. The primary source of potassium for the general population is the diet, as potassium is found in all foods, particularly vegetables and fruits. It is seldom, if ever found in drinking waters at levels that could be a concern for healthy humans, thus the WHO has not issued a health-

based guideline value for potassium in drinking water. The recommended daily requirement of potassium is about 3g. Potassium occurs widely in the environment, including all natural waters, and can occur in drinking water as a result of the use of potassium permanganate as an oxidant in water treatment.

In 2015, 1,229 of the 1,979 samples analysed contained ≤1mg/L potassium. 96 samples contained >5mg/L, with 8 of these found to contain >20mg/L potassium.

In 2016, 1,203 of the 2,076 samples analysed contained ≤1mg/L potassium. 126 samples contained >5mg/L, with 12 of these found to contain >20mg/L potassium.

3.7.13 Selenium and selenium compounds

Selenium is an essential element for humans, and foodstuffs such as cereals, meat and fish are the principal source of selenium for the general population. Selenium plays a crucial role in controlling the effects of thyroid hormone on fat metabolism. There are indications that selenium status may be marginal in many parts of the world, including Western Europe. Selenium is released from natural and human-made sources, with the main source being the burning of coal.

The major use of selenium is in the manufacture of electronic components and in photography. Selenium compounds are used in some insecticides, in hair shampoos (as an anti-dandruff agent) and as a nutritional feed additive for poultry and livestock.

In 2015, 2 samples were non compliant with respect to the EU parametric value of 10µg/L. 1 of these samples was also non compliant with respect to the WHO guideline value of 40µg/L. In 2016, all 1,444 samples analysed were compliant for selenium.

3.7.14 Sodium

Sodium salts (e.g. sodium chloride) are found in virtually all foods and drinking water. Foods are the main source of exposure. The WHO has not issued a guideline value, as the contribution from drinking water to daily sodium intake is small. Although the taste threshold concentration of sodium in drinking water depends on the associated anion and the temperature of the solution, the average threshold is 200mg/L at room temperature. The results for 2015 and 2016 are detailed in Table 3.7.

3.7.15 Zinc

Zinc is an essential trace element found in virtually all food and drinking water in the form of salts or organic complexes. It is vital for many biological functions such as disease resistance, wound healing, digestion and reproduction. The major uses of zinc include anti-corrosion coatings on steel (galvanizing), construction materials, brass, pharmaceuticals and cosmetics.

Zinc imparts an undesirable astringent taste to water at the taste threshold of 3mg/L (as zinc sulphate). Water containing zinc at levels above this threshold may appear opalescent and develop a greasy film on boiling. Although levels of zinc in drinking water normally do not exceed 0.1mg/L, concentrations in tap water can be much higher, due to dissolution of zinc from household plumbing.

In 2015, 118 samples contained >0.10mg/L zinc, although only 1 of these were found to contain >3.0mg/L. In 2016, 94 samples contained >0.10mg/L zinc, although only 1 of these were found to contain >3.0mg/L.

3.8 Private Samples

The laboratory provides a comprehensive testing service for the general public to investigate concerns or complaints about water quality. These concerns are predominantly associated with private wells.

The number of samples tested for private individuals in 2015 and 2016 were 759 and 1,419 respectively. The data presented in this report indicates that private wells have a higher level of non-compliances than public water supplies. Further information and advice on private wells can be located on www.hse.ie

3.9 Haemodialysis Water

Haemodialysis units operate water treatment systems to produce purified water for use in Dialysis machines. The laboratory analysed 422 samples in 2015 and 392 samples in 2016. The parameters analysed include pH, conductivity, sodium, potassium, total hardness, fluoride and a range of metals.

Table 3.7 Summary of Metals in drinking water results for 2015 and 2016

Parameter	IARC Rating	Parametric Value (S.I. 122 of 2014)	WHO Guideline Value	2015 Samples Analysed	2015 Exceedances	2016 Samples Analysed	2016 Exceedances
Aluminium	n/a	200 µg/L	-[4]	3,712	64	3,904	115
Antimony	Group 2B[3]	5.0 µg/L	20 µg/L	1,198	10	1,471	4
Arsenic	Group 1	10 µg/L	10 µg/L	1,199	36	1,505	60
Boron	n/a	1.0 mg/L	2.4 mg/L	1,152	7	1,432	3
Cadmium	Group 2A	5.0 µg/L	3.0 µg/L	1,173	0	1,451	0
Chromium	Group 1[1]	50 µg/L	50 µg/L	1,176	1	1,451	1
Copper	n/a	2.0 mg/L	2.0 mg/L	1,296	38	1,498	33
Iron	n/a	200 µg/L	-[4]	3,700	308	3,845	334
Lead	Group 2A	10 µg/L	10 µg/L	1,517	113	1,584	54
Manganese	n/a	50 µg/L	-[4]	3,692	253	3,856	257
Nickel	Group 2B	20 µg/L	70 µg/L	1,219	34	1,475	43
Potassium	n/a	-	-[4]	1,979	-	2,076	-
Selenium	Group 3	10 µg/L	40 µg/L	1,160	2	1,444	0
Sodium	n/a	200 mg/L	-[4]	1,987	66	2,077	114
Zinc	n/a	-	-[4]	1,217	[2]1	1,461	[2]1

[1] *Classification refers to hexavalent Chromium*
[2] *The number of zinc samples which gave results >3.0mg/L. (There is no health-based guideline value for zinc although a level of >3mg/L may not be acceptable to consumers.)*
[3] *Classification refers to antimony as antimony trioxide.*
[4] *Guideline value not established as the levels found in drinking water are not of health concern.*

3.10 Bathing Waters

Bathing waters and inlet streams to bathing areas were tested for compliance with the Bathing Water Quality Regulations 2008 (S.I. No. 79 of 2008).

In 2015 and 2016, 89 and 90 samples respectively were analysed. Further details and results for both local and national bathing water quality can be found at www.splash.epa.ie

3.11 Pool Waters

The laboratory analyses chlorine/bromine levels, along with pH, total dissolved solids and alkalinity of swimming pools, jacuzzis, hot tubs and spa pools.
In 2015, 339 samples were analysed. At present there is no legislation for the control of these parameters. 36 of the samples were found to contain >5mg/L free chlorine, with 13 of these also found to contain >10mg/L free chlorine. In the case of the total chlorine levels, 47 of the samples were found to contain >5mg/L total chlorine, while 24 of these also contained >10mg/L total chlorine. The total dissolved solids varied from 137 to 6,585mg/L, with 9 samples found to contain more than 5,000mg/L. The alkalinity levels varied from <10 to 331mg/L.

In 2016, 477 samples were analysed. The pH values obtained ranged from 3.9 to 8.8. 32 of the samples were found to contain >5mg/L free chlorine, with 11 of these also found to contain >10mg/L free chlorine. In the case of the total chlorine levels, 60 of the samples were found to contain >5mg/L total chlorine, while 25 of these also contained >10mg/L total chlorine. The total dissolved solids varied from 81 to 7,752mg/L, with 2 samples found to contain more than 5,000mg/L. The alkalinity levels varied from <10 to 412mg/L.

3.12 Effluents

The laboratory carries out a range of analysis on effluent samples. These samples include samples for discharge licences and suspected pollution samples. 19 samples were analysed annually in 2015 and 2016. The parameters tested include Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), suspended solids, fats, oils and greases (FOGs), dissolved oxygen, phosphate (both soluble and total), nitrate, nitrite, ammonia and a range of metals.

4. AIR POLLUTION MONITORING

Air Pollution is a global issue. The WHO have confirmed that air pollution is now the world's largest single environmental health risk. In 2014, the WHO released figures based on global deaths in 2012. The WHO estimate that in 2012 around 7 million people died (1 in 8 of total global deaths) – as a result of air pollution exposure. To put these figures in context, the WHO estimated that in 2012, approximately 3.3 million net deaths, or 6% of all global deaths, were attributable to alcohol consumption.

Further analysis of the data revealed a stronger link between both indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischaemic heart disease, as well as between air pollution and cancer. This is in addition to air pollution's role in the development of respiratory diseases, including acute respiratory infections and chronic obstructive pulmonary diseases. Low and middle income countries in the WHO had the largest air pollution-related burden in 2012. Included in the assessment is a breakdown of deaths attributed to specific diseases, underlining that the vast majority of air pollution deaths are due to cardiovascular diseases as follows:

Outdoor air pollution-caused deaths – breakdown by disease:
- 40% – ischaemic heart disease;
- 40% – stroke;
- 11% – chronic obstructive pulmonary disease (COPD);
- 6% - lung cancer; and
- 3% – acute lower respiratory infections in children.

Indoor air pollution-caused deaths – breakdown by disease:
- 34% - stroke;
- 26% - ischaemic heart disease;
- 22% - COPD;
- 12% - acute lower respiratory infections in children; and
- 6% - lung cancer.

The data released by the WHO show that the risks from air pollution are now far greater than previously thought or understood, particularly for heart disease and strokes. Dr Maria Neira, Director of WHO's Department for Public Health, Environmental and Social Determinants of Health stated that "Few risks have a greater impact on global health today than air pollution; the evidence signals the need for concerted action to clean up the air we all breathe". The WHO estimated that indoor air pollution was linked to 4.3 million deaths in 2012, while outdoor air pollution was linked to 3.7 million deaths. Many people are exposed to both indoor and outdoor air pollution. Due to this overlap, mortality attributed to the two sources cannot simply be added together, hence the total estimate of around 7 million deaths in 2012.

In general, Irelands' air quality compares favourably with other EU member states. This is due to the relative absence of large cities, weather and access to predominantly clean air masses from the south west. However, this status is merely a comparison, as many of our European neighbours are in exceedance of EU limits for pollutants such as particulate matter, ozone and nitrogen dioxide. When we compare our air quality levels to those recommended by the World Health Organisation, the situation is less positive. As a nation, we need to reduce the levels of particulate matter and ozone to levels below those recommended by the WHO Air Quality Guidelines. According to the Air Quality in Ireland 2015, published by EPA, around 1,200 deaths in Ireland in 2012 were directly linked to air pollution.

4.1 European Legislation

The EU has set down air quality standards in Ireland and the other member states for a wide variety of pollutants. These standards include how we should monitor, assess and manage ambient air quality.

The European Commission set down the initial principles to this approach in 1996 with its Air Quality Framework Directive. Four "Daughter" directives lay down limits for specific pollutants:

- 1st Daughter Directive: Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead
- 2nd Daughter Directive: Carbon monoxide and benzene
- 3rd Daughter Directive: Ozone
- 4th Daughter Directive: Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was issued in 2008. It replaced the 1996 Framework Directive and the first, second and third Daughter Directives. **This CAFE directive sets out how Air Quality should be monitored, assessed and managed, and sets limits for the following parameters; Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter, lead, benzene, carbon monoxide and ozone.**

The '**Fourth Daughter Directive**'(2004/107/EC) will be included in CAFE at a later stage. The CAFE Directive was transposed into Irish legislation by the '**Air Quality Standards Regulations 2011**'(S.I. No. 180 of 2011). It replaces the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and S.I. No. 33 of 1999.

The fourth Daughter Directive was transposed into Irish legislation by the '**Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009**' (S.I. No. 58 of 2009).

To underpin the European Union's continuing efforts to improve air quality, the European Commission carried out a comprehensive review of the EU air quality policy framework between 2011 and 2013. This review also considered strategic options for addressing the main outstanding problems. The associated impact assessment confirmed that the benefits of clean air policies continue to significantly exceed the cost of action. As a result of this review, the Commission adopted a Clean Air Policy Package in 2013, consisting of a new Clean Air Programme for Europe with new air quality objectives for the period up to 2030, a revised National Emission Ceilings Directive with stricter national emission ceilings for the six main pollutants, and a proposal for a new Directive to reduce pollution from medium-sized combustion installations.

4.2 National Legislation

The country is divided into four zones for the purpose of assessment and management of air quality.

Zone A is occupied by Dublin.

Zone B is occupied by Cork.

Zone C is occupied by Galway City along with Limerick City, Waterford City and 21 other towns and urban areas around the country. The number of monitoring stations within each zone is also stipulated.

Zone D consists of the remainder of the country outside the above areas.

4.3 Laboratory Results

Traditionally, the laboratory has operated air monitoring stations at two locations in the city, near the junction formerly known as the 'Bodkin roundabout' (adjacent to Currys) and at Terryland Waterworks. However, the station at Terryland Waterworks is no longer operational, due to the equipment failure.

This work is performed on behalf of Galway City Council. The parameters monitored are Sulphur Dioxide, Black Smoke and PM_{10}.

Data recorded by the laboratory is reported to and published by the EPA.

4.3.1 Black Smoke

Black smoke measurement was the traditional method for determining the amount of particulate matter (PM) in the air. Legislative guidelines date back to 1980. Black smoke consists of fine particles suspended in air, which mainly arise from the incomplete combustion of fossil fuels, such as coal, oil and peat, in the residential, industrial or transport sectors. Open fires in dwelling houses are a major source of much of the particulate material emitted to air as smoke. Black smoke is an historic method of PM sampling which is roughly equivalent to measuring PM_4.

Since Jan 2005, there is no legislative requirement to measure this parameter; however the laboratory continues to perform this measurement at both monitoring stations. Given the data that has been collected over many years, it is considered useful to continue this measurement to facilitate the observation of long term trends.

The results for 2015 and 2016 are detailed in Appendix 6A.

4.3.2 Sulphur Dioxide

Sulphur Dioxide gas is formed and released into the atmosphere from combustion of sulphur containing fuels (mainly coal and oil). The predominant natural source of sulphur dioxide comes from the eruption of volcanoes.

The negative health effects from elevated levels of SO_2 include aggravation of asthma, reduction in lung function and inflammation of the respiratory tract. High levels of SO_2 can also lead to damage of the ecosystem, as it is a major precursor to acid rain, leading to acidification of rivers and lakes.

The regulations stipulate one SO_2 monitor in zone C. The EPA operates a mobile monitoring station in this zone. The laboratory continues to monitor for SO_2 in the city.

The daily limit value set for the protection of public health is 125µg/m^3. No more than three exceedances are permitted per year. The results for 2015 and 2016 are detailed in Appendix 6B. The limit was not exceeded in 2015 or 2016.

4.3.3 PM_{10}

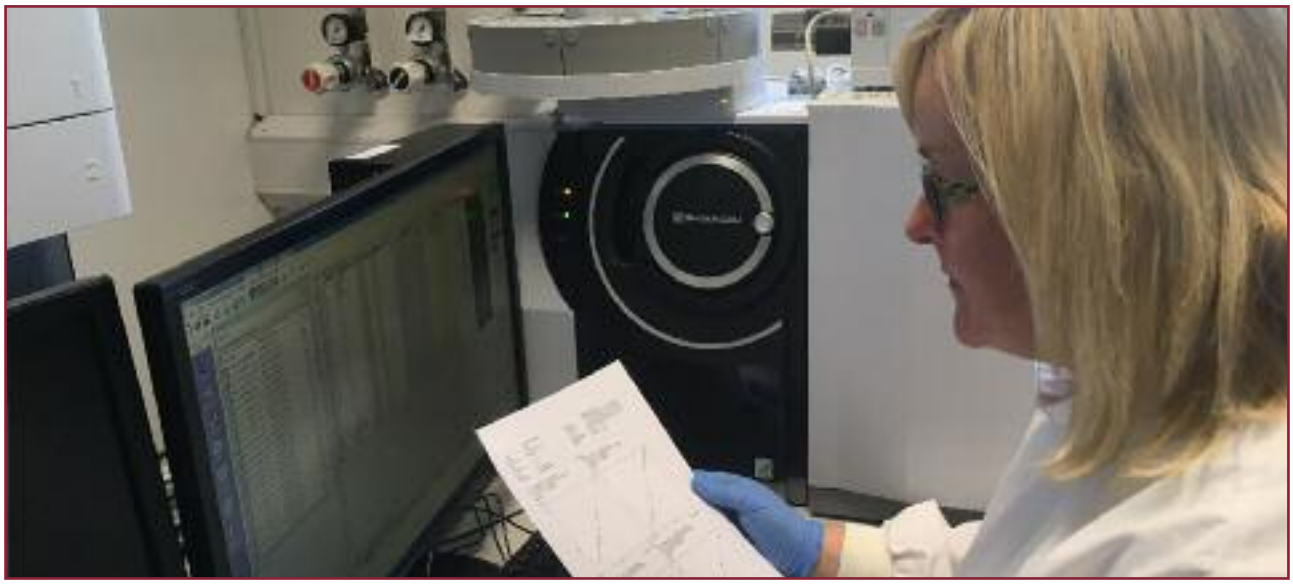
PM_{10} is the term used to describe particulate matter which is 10µm or less in diameter. These particles may consist of a complex mixture of soot, organic, and inorganic matter. In Ireland, contributors to PM_{10} are solid fuel burning and vehicular traffic. Agriculture is also a significant source of secondary particulate matter, primarily through formation of aerosols from ammonium nitrates for example.

Elevated PM_{10} levels are related to increases in cardiovascular disease, lung diseases and heart attacks/arrhythmias.

The Air Quality Regulations require monitoring at two locations in Zone C. The EPA operates one such monitoring unit in a mobile facility. The other monitoring unit is operated by the laboratory at the junction formerly known as the 'Bodkin roundabout' monitoring station.

The Regulations set a 24 hour average limit of 50µg/m^3 which is not to be exceeded more than 35 times a calendar year, and a yearly average limit of 40µg/m^3 for PM_{10}. The average value obtained for 2015 was 15µg/m^3. The 24 hour average limit was exceeded twice in the course of 2015. The average value obtained for 2016 was also 15µg/m^3. The 24 hour average limit was exceeded on three occasions during 2016. The results for the year 2015 and 2016 are detailed in Appendix 6C & 6D.

There are no results available for periods during both 2015 and 2016. This is due to a number of equipment breakdowns. Such breakdowns are inevitable due to the aging instrumentation employed, which is in need of replacement.



5. PHARMACEUTICALS & TOXICOLOGY

5.1 Pharmaceutical Laboratory

Since 1976, the laboratory has provided an analytical service to the Health Products Regulatory Authority (HPRA), previously the Irish Medicines Board (IMB) and the National Drugs Advisory Board, to test drug products and medicines, as well as providing technical advice and support related to the testing of medicines.

The Pharmaceutical Section of the Public Analyst's Laboratory, Galway has been appointed an Official Medicines Control Laboratory (OMCL) under the framework of the European Directorate for the Quality of Medicines and Healthcare (EDQM) and the Council of Europe.

5.1.1 Role as an Official Medicines Control Laboratory (OMCL)

The function of the HPRA is to protect and enhance public and animal health through the regulation of human and veterinary medicines and medical devices available for sale, or manufactured, in Ireland and to participate in systems designed to do the same throughout the EU.

At a National level, the laboratory contributes to the protection of public health and the regulatory function of the HPRA by providing independent analytical data and technical advice on medicinal products that enable the HPRA to make informed decisions on the quality and the compliance status of medicines.

At a European level, the laboratory actively participates in the work of the General European OMCL Network (collaboration between regulatory medicine testing laboratories designed to improve communication, enhance cooperation and to harmonise methods of work across the EU and other states). Activities include the testing of Centrally Authorised Medicinal Products (CAP), testing of Mutually Recognised/Decentralised Products (MRP/DCP), Market Surveillance Studies (MSS) and participation in EDQM organised Proficiency Testing Studies (PTS). (for more information see http://www.edqm.eu/en/General-european-OMCL-network-46.html

5.1.2 Analysis

Testing of Pharmaceuticals in the laboratory is carried out according to the monographs of the European Pharmacopoeia, the British Pharmacopoeia, the United States Pharmacopoeia and/or company methods. Both Active Pharmaceutical Ingredients and Finished Medicinal Products are analysed. Tests carried out during 2015 and 2016 included Identification and Assay by HPLC, Dissolution by UV, Dissolution by HPLC, Identification and Assay by UV-Vis, Appearance Testing, Packaging Checks, Identification by FT-IR, Average Mass, Uniformity of Mass, Subdivision of Tablets, Disintegration, pH, Density, Melting Point, Specific Optical Rotation, Related Substances by HPLC, Uniformity of Dosage Units, Water Content by Karl Fischer, Loss on Drying, Identification of Glycerol and Presence of Diethylene Glycol by GC-MS, Insoluble Matter and Number of Deliveries Dispensed.

5.1.3 Sample Numbers

The number of samples submitted to the laboratory was 178 during 2015 and 153 during 2016.

Sample Source	Number of Samples (2015)	Number of Samples (2016)
Irish Medicines Board/Health Products Regulatory Authority	152	133
EDQM - Centrally Authorised Medicinal Products	5	4
Enforcement Samples	4	0
Marketing Surveillance Study	1	0
Proficiency Tests	16	16

A summary of analytical findings may be found in the HPRA 2015 and 2016 Annual Reports, when available (see www.hpra.ie)

5.1.4 OMCL Quality System

To ensure quality and comparability of results within the OMCL Network, labs must operate to a quality system based on ISO/IEC 17025. The laboratory has been accredited for the analysis of Pharmaceuticals since 1991 (EN45001) and, since 2006, to the current standard, ISO/IEC 17025:2005. A "Flexible Scope" approach has been applied to a number of tests in the laboratory.

As an OMCL, the laboratory is also required to operate to Quality Management Guidelines issued by the EDQM-OMCL Network and accepted by the EA (European Accreditation Cooperation) (see http://www.edqm.eu/en/EDQM-Publications-Quality-Management-Guidelines-86.html for more information). Mutual Joint Audits (MJAs) of OMCLs are carried out by experts from the Network, trained in Quality Management to ensure that the quality management systems of the OMCLs comply with the requirements of ISO/IEC 17025 and the OMCL Network Quality Management Guidelines.

The OMCL has previously undergone a MJA by auditors from other European countries and two members of staff have been trained as MJA auditors.

The OMCL is also audited periodically by the HPRA.

5.1.5 Proficiency Testing Schemes (PTSs)

During 2015 and 2016 the OMCL took part in 17 PTSs organised by EDQM, and 15 PTSs organised by Pharmassure.

Techniques included Disintegration, Dissolution, Assay by HPLC, Assay by UV, Volumetric Titration, Potentiometric Titration, UV Spectrophotometry, pH, Density, Melting Point, Loss on Drying, FT-IR, Karl Fischer, Specific Optical Rotation, Average Mass, Uniformity of Mass and Appearance.

5.1.6 OMCL Ireland Activities within the General European OMCL Network

OMCL Ireland took part in a new Market Surveillance Study (MSS0048) on Sub-division of Tablets (using historical data), which was carried out on commercialised medicines having a national marketing authorisation. The product was tested on the basis of national sampling procedures, according to a common protocol. The results of these studies are important to ensure that the same types of medicines are of comparable quality throughout different member states. These studies may support revision of the relevant European Pharmacopoeia monographs and/or general chapters and methods. In addition the laboratory participated in two Centrally Authorised Products projects in 2015/2016. The products were tested using common protocols/methods supplied by the EDQM/OMCL network and the aims of these projects are as outlined above for MSS.

5.1.7 Attendances

Staff from the laboratory attended the following training events and meetings:
• OMCLs – Pharmaceutical Industry Technical exchange about counterfeit testing: Meeting Strasbourg, April 2015
• OMCL Network Annual Meeting, Brussels, June 2015
• Working group – OMCL guideline for Management of Documents, Strasbourg, September 2015,
• Annual CAP/MRP/DCP meeting, Zagreb, November 2015
• Annual CAP/MRP/DCP meeting, Uppsala, November 2016.

Attendances were funded by the Health Products Regulatory Authority and/or the Council of Europe.

5.1.8 Student Placement

One 3rd year student from the Forensics Science and Analysis Course, Galway Mayo Institute of Technology worked in the OMCL on a six month placement during 2015.

5.2 Toxicology Laboratory

A basic toxicology service is offered to Consultant Pathologists and Physicians, Veterinary Surgeons and members of the public, mainly for alcohol (ethanol) testing. Some other parameters are tested for periodically e.g. Strychnine and Paraquat, as well as solvents such as Acetone, Methanol, Acetaldehyde, Propanol etc.

5.2.1 Paraquat Testing

In 2015, the laboratory received one Intensive Care Unit (ICU) sample for Paraquat in Urine testing.

5.2.2 Ethanol Testing

The majority of samples submitted for alcohol testing are submitted by Consultant Pathologists in HSE West. Blood and urine "B-samples", taken under the Road Traffic Act, are also independently analysed for alcohol. The current limits for ethanol in drink driving offences are 67 mg/100 ml in urine and 50 mg/100 ml in blood for experienced drivers, with lower limits for new or learner drivers and drivers of buses, lorries, vehicles with trailers, work vehicles, taxis and other public service vehicles.

14 samples taken under the Road Traffic Act were tested during 2015, of which 10 (i.e. 71 %) were above the legal limit (for experienced drivers) at the time of testing. In 2016, 16 samples taken under the Road Traffic Act were tested, of which 13 (i.e. 81 %) were above the legal limit (for experienced drivers) at the time of testing.

The total number of Toxicology Samples tested was 202 for 2015 and 250 for 2016, made up as follows;

Year	2015	2016
Paraquat in Biological Fluids (I.C.U)	1	0
Ethanol in Biological Fluids (Post Mortem/Legal)	120	165
Ethanol in Biological Fluids (Road Traffic Act)	14	16
Ethanol Proficiency Tests	25	24
Ethanol (Foodstuffs, Misc.)	33	42
Ethanol and other volatiles (Misc.)	9	3

5.2.3 Toxicology Quality System

The laboratory takes part in a Proficiency Testing Scheme coordinated by the LGC, where samples of blood and urine are each received on a monthly basis and analysed for ethanol (in general 12 urine alcohols and 12 blood alcohols per annum).

6. COSMETICS

6.1 Cosmetics Legislation and Enforcement

The European "recast" Cosmetics Regulation (EC No. 1223/2009) has been transposed into Irish law by SI 440 of 2013. The legislation sets out standards which must be met by the Cosmetics Industry, including manufacturers, importers, distributors and retailers. Official control of cosmetics in Ireland is coordinated by the Health Products Regulatory Authority (HPRA), as the national Competent Authority, along with the HSE (Environmental Health Officers (EHOs) and Public Analysts' Laboratories (PALs), authorised officers and official laboratories respectively). A National Cosmetics Surveillance Forum, with membership from the HPRA, EHS and PA Labs facilitates the planning and coordination of control and market surveillance activities. A national HSE Sampling and Analysis Programme is produced yearly, covering microbiological and chemical surveillance of market-level produce. At laboratory level, testing is organised as follows: microbiological testing by Public Analyst's Lab (PAL) Dublin; chemical testing by PALs Cork and Galway (different testing performed).

International collaboration of the official cosmetics control labs is facilitated by the OCCL, of which we are a member. This is a network of Official Cosmetics Control Laboratories formed within the European Directorate for the Quality of Medicines and HealthCare (EDQM), with cross functional links to the European Commission PEMSAC Analytical Methods Group (Platform of European Market Surveillance for Cosmetics). The laboratory also attends meetings of the PEMSAC network.

RAPEX is the EU rapid-alert system for notifying hazards/risks associated with cosmetics and other, general consumer products (excluding food, medicines etc.). Recent annual reports can be found at the following links:
http://ec.europa.eu/consumers/consumers_safety/safety_products/rapex/reports/docs/rapex_annual_report_2015_en.pdf
http://ec.europa.eu/consumers/consumers_safety/safety_products/rapex/alerts/repository/content/pages/rapex/reports/docs/rapex_annual_report_2016_en.pdf
In Ireland the Competition and Consumer Protection Commission (CCPC) formerly the National Consumer Agency (NCA) administers RAPEX. http://www.consumerhelp.ie/

6.2 Results for 2015 and 2016

Table 6.1 below summarises testing of cosmetics performed in this laboratory in 2015 & 2016 (see Appendix 7 for outline of the Surveillance Programme for 2015 & 2016). The service is provided to authorised officers (EHOs) from all HSE Regions.

Cosmetics samples are submitted by the HSE authorised officers (Environmental Health Officers), or occasionally the HPRA, to monitor compliance with the cosmetics regulations. Non-complying samples are dealt-with by the EHOs, in conjunction with the HPRA as appropriate.

6.2.1 Formaldehyde in Hair-straighteners, etc

General: EU cosmetics legislation (see Section 6.1) regulates formaldehyde strictly, setting a maximum limit of 0.2% for formaldehyde in general cosmetics products.

Formaldehyde solutions can release formaldehyde gas under certain conditions. Formaldehyde has high inhalation toxicity and is also a known skin 'sensitiser'. Therefore, all finished cosmetics products containing formaldehyde (or other preservatives which release formaldehyde) must be labelled with the warning "contains formaldehyde" where the concentration of the formaldehyde exceeds 0.05%.

Both in 2015 and 2016, 35 cosmetic samples consisting of various Irish manufactured cosmetic products were tested for formaldehyde content. No non-compliances were found in either year. The problem of inclusion of formaldehyde in hair-straighteners has decreased overall from 2010 levels, and so the focus of the testing was changed to general cosmetics. Non-Compliances 2010: 52% (16/31), 2011: 19% (5/27), 2012: 21% (4/19), 2013: 4% (1/28), 2014: 9% (2/23), 2015: 0% (0/35), 2016 (0/35). These results may indicate a reduced/altered need for surveillance in this area.

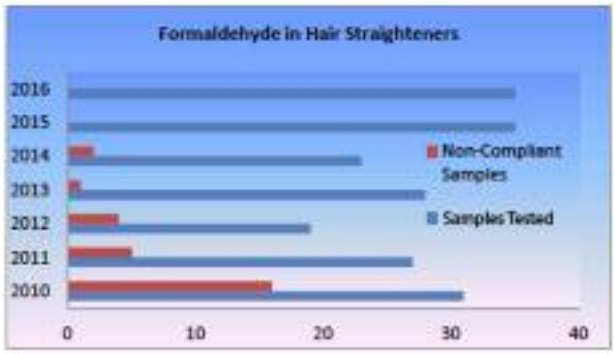


Table 6.1 Summary of Official Cosmetics Testing Results 2015 & 2016

Parameter	Cosmetic Types	2015 Samples Tested	2015 Complying	2015 Non-complying	2016 Samples Tested	2016 Complying	2016 Non-complying
Formaldehyde	Irish Manufactured Cosmetics, Hair Straightening products, & Children's 'leave-on' Cosmetics	35	35	0	33	33	0
Lead[1]	Face paints, Low cost Children's & General make up etc.	65	65	0	80	80	0
Cadmium[1]	Face paints, Low cost Children's & General make up etc.	64	64	0	80	80	0
Mercury	Creams, Soaps, Low cost leave on products, etc.	11	11	0	0	0	0
Arsenic	Face paints, Low cost Children's & General make up etc.	46	45	1	69	69	0
Chromium	Face paints, Low cost Children's & General make up etc.	51	51	0	73	73	0
Nickel	Face paints, Low cost Children's & General make up etc.	37	37	0	65	65	0
Hydrogen Peroxide	Teeth whitening products, toothpaste	39	38	1	29	28	1
p-Phenylenediamine	Hair Dyes	37	37	0	38	37	1
Hydroquinone	"Lightening" Creams, Soaps	9	6	3	N/T	N/A	N/A
General Labelling Examination	Make up, face paints, soaps, shower gels, hair products, wipes, creams etc	80	38	42*	67	48	19*
Presence of prohibited substances	Various cosmetics	3	0	3	13	0	13

Notes:
a) [1]An XRF screening analysis is initially carried out on samples to determine which need confirmatory analysis by ICP-MS. In 2015, 392 sub-samples were screened by x-ray fluorescence for lead and cadmium. In 2016, 296 sub-samples were screened by x-ray fluorescence for lead and cadmium.
*b) *Non-complying with the labelling requirements of Regulation (EC) No. 1223/2009.*
c) Two private samples were tested for formaldehyde in 2016 and both were compliant.
d) In 2015 a single sample of Tooth Powder contained Arsenic at a level of 12.8mg/kg.
e) N/T = not tested.

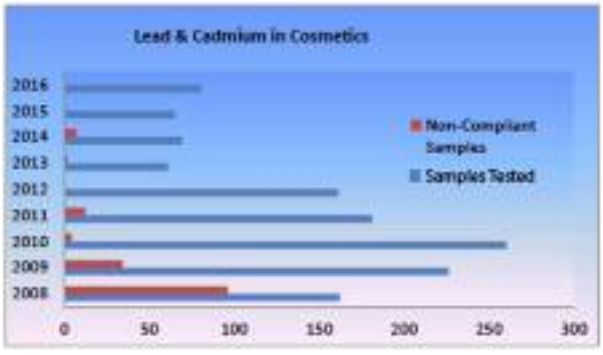
6.2.2 Heavy Metals

Lead and Cadmium: 65 and 80 samples (children's face paints, children's general cosmetics and various adult products) were tested here in 2015 and 2016 respectively. Some of these samples were multi-component cosmetics sets consisting of different component types and colours. In total, 392 sub-samples were screened by XRF in 2015 and 296 in 2016. The large number of sub-samples screened reflects the multi-component nature of many of the samples analysed. A Lead (Pb) limit of 20 mg/kg and a Cadmium (Cd) limit of 5 mg/kg (limits developed by BfR/Germany) have been adopted by the HSE as an interim 'limit'. No samples exceeded these limits in either 2015 or 2016 – see results in Table 6.2 below. In 2015, 14 samples consisting of 25 subsamples, contained levels of lead between 5 and 20 mg/kg, these are of interest as work is ongoing at a European level to determine if the BfR/German limit should be reduced from 20 mg/kg to an, as yet undecided, lower value. In 2016, 2 samples, consisting of 5 subsamples, contained levels of lead between 5 and 20 mg/kg.

Table 6.2 Non-complying results for Lead & Cadmium in Cosmetics

Year	No of Samples Tested	No of sub components	No. of Non-complying components
2008	162	798	96
2009	226	946	34
2010	260	1,020	4
2011	181	680	12
2012	161	635	0
2013	61	213	1
2014	69	771	7
2015	65	392	0
2016	80	296	0

The number of non-complying results for Lead and Cadmium show a significant decrease in recent years, suggesting an improvement in the quality of products on the market.



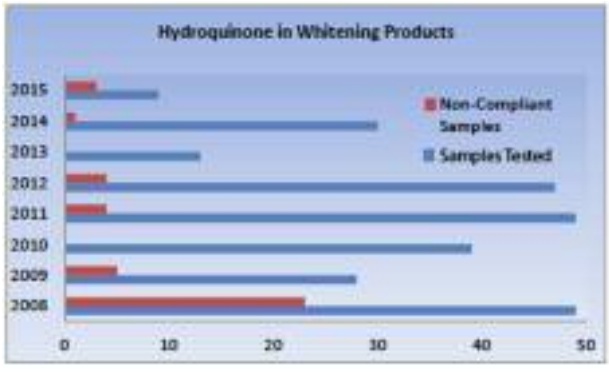
In 2015, 51 samples were also tested for Arsenic, Chromium and Nickel; 73 samples were tested in 2016. Arsenic results ranged from <0.5 to 47 mg/kg in 2015 (elevated arsenic levels were found in two seaweed-based products due to naturally occurring arsenic in seaweed, and also in a tooth powder sample) and <0.5 to 1.8 mg/kg in 2016. Chromium levels ranged from <0.5 to 53 mg/kg in 2015 and <0.5 to 89 mg/kg in 2016, high levels of chromium can be observed in cosmetic products due to the use of permitted, chromium-containing colourants.

Levels of Nickel of up to 47 mg/kg were found in some samples in 2015 and up to 8.7 mg/kg in 2016. Whereas there are no specific limits for Nickel in cosmetics, cosmetics products must (a): be safe and (b): must not contain prohibited substances unless "…technically unavoidable in good manufacturing practice". To minimise the risk of sensitisation (to Nickel) in sensitive persons, Nickel levels in cosmetics should be minimised. Some studies report 5 mg/kg as a 'threshold' for leave-on cosmetics (Basketter et al., Contact Dermatitis, 2003 Jul; 49(1):1-7). It is hoped the European Commission will review this issue. In 2015, 33% of samples and sub-samples analysed here contained >5mg/kg of Nickel, 5% in 2016.

6.2.3 Hydroquinone and Mercury in Creams, etc.

Hydroquinone containing products are popular for their skin-lightening properties in Asian and African cosmetic markets. RAPEX reports involving hydroquinone are relatively common (on a European level). Hydroquinone (at any level) is prohibited for use as a skin-lightening agent.

During 2015, 33% (3/9) of samples analysed here were found to contain hydroquinone. These results compare to 47% (23/49), 18% (5/28), 0% (0/39), 8.0% (4/49), 8.5% (4/47), 0% (0/13), and 3.3% (1/30) for 2008, 2009, 2010, 2011, 2012, 2013, and 2014 respectively. In 2016, hydroquinone analysis was discontinued in Galway PAL and the analysis is now carried out by Cork PAL.



6.2.4 para-Phenylenediamine in Hair Dyes

In 2015, 37 samples of hair dyes were tested for para-phenylenediamine (PPD), a permitted hair colourant with allergic properties and a legislative limit of 2% (after mixing). All 37 complied. 38 samples were analysed in 2016 with one sample giving a non-complaint result of 4.7% PPD.

6.2.5 Hydrogen Peroxide

"Tooth-whitening" products, toothpastes, gels and related products are currently in widespread use by the public. Hydrogen peroxide is permitted in "oral hygiene products…available generally to public" up to a maximum limit of 0.1% (see SI 396 of 2012) and up to 6.0% for professional use. Levels of hydrogen peroxide >6.0% are prohibited.

A new HPLC method was established and developed in the laboratory in 2014, in conjunction with laboratories in France and the Netherlands (OCCL members). This method was used to analyse samples here and also to participate in a cross-laboratory validation exercise, the results of which showed the method to be robust and reliable.

39 samples were analysed in 2015, and one non-compliance was found where 2 components of a tooth whitening system had hydrogen peroxide levels of 0.33% and 0.34%. In 2016, 1 sample (a tooth whitening pen) of 29 analysed was found to have a hydrogen peroxide level of 13.6%. This issue was dealt with by the EHS and HPRA.

6.2.6 General Labelling of cosmetics

80 samples were examined in 2015 for compliance with the labelling requirements in the Cosmetics Regulations (Regulation No 1223/2009 & S.I. 440 of 2013). 42 samples (53%) were found to be non-compliant. In 2016, 28%, or 19 samples of 67 examined, were found to be non-compliant.

These non-compliances related to the omission of some, or all, of the following labelling information: Responsible Persons (RP) address, date of minimum durability (or 'period after opening' symbol), batch number, and list of ingredients. Some were found not to have the labelled information in the English language.

In addition, in 2015, 3 samples had prohibited substances labelled in their ingredients list, while 13 samples had labelled prohibited substances in 2016. This was related to the presence of sodium perborate in hair dye products. Since August 2013 Commission Regulation (EU) No 758/2013 (amending Regulation (EC) No 1272/2008) on Classification, Labelling and Packaging of Substances has reclassified Sodium Perborate as CMR 1B reprotoxic. This work was done in conjunction with HSE Environmental Health Officers following information received from HPRA regarding the reclassification of sodium perborate.

6.3 Overall Summary

The recent surveillance results indicate continuing improvements in the quality of cosmetics on the Irish market. Non-compliances have shown a decrease significantly since 2008 for almost all tested parameters. There continues to be some incidences of non-compliances which are dealt with by the EHOs in conjunction with the HPRA, as appropriate.

7. MISCELLANEOUS TESTING

Twenty three 'miscellaneous' samples were received in 2015. These consisted of:

- 9 chlorite solutions (MMS, 'Miracle Mineral Solution'), as part of investigations into their illegal use as medicines.
- 1 sample of rodent droppings for identification
- 2 insects for identification
- 1 worm for identification
- 1 sample of residue from a water trough
- 1 deposit from a pump seal
- 1 foreign object for identification
- 7 private samples for Sodium analysis

In 2016, four 'miscellaneous' samples were analysed, consisting of:

- 2 foreign objects for identification
- 1 sample of milk and a stone for metals analysis (part of an investigation into a cow's illness)
- 1 infant intravenous feeding solution for Calcium analysis

8. QUALITY ASSURANCE

The quality of the analysis carried out in this laboratory, and the reliability of the results supplied to our customers is ensured by having a quality assurance system in place which covers all aspects of the laboratory's work. This laboratory complies with an International standard for testing laboratories i.e. ISO/IEC 17025 'General requirements for the competence of testing and calibration laboratories'. The standard contains detailed requirements for both the management of laboratory operations and technical aspects such as method validation, measurement traceability and measurement uncertainty.

8.1 Accreditation

In Ireland, the Irish National Accreditation Board (INAB) is the body with responsibility for awarding accreditation for chemical laboratories to the ISO 17025 standard.

This laboratory has continuously added to its list of accredited tests, and now is accredited for a wide range of analytes, using a variety of testing procedures in Food, Water, Cosmetic and Pharmaceutical products. The laboratory has a 'flexible scope' accreditation in a number of areas including Pharmaceutical Testing, Trace Elements in Food by ICP-MS, Allergens in Food by ELISA, Sodium and Potassium in Foods, and flexibility regarding matrix for a number of Liquid Chromatographic methods in food. The flexible scope system allows the laboratory to add to its scope of accreditation between external assessments audits, following satisfactory validation of new procedures. The flexible scope option is available to laboratories who have shown previous competence in the development and validation of test methods.

A full list of our accredited tests is available on the INAB website: http://www.inab.ie

8.2 Irish National Accreditation Board (INAB) External Audit

The laboratory receives regular surveillance and re-assessment audits from INAB. Their purpose is to determine whether a laboratory is continuing to comply with the ISO 17025 and INAB Regulations. In December 2015 we were subject to a surveillance audit from INAB and in October 2016 the laboratory underwent a re-assessment audit by INAB. We successfully maintained our accreditation status and also added to our scope of testing.

Additional testing accredited in 2015, included the introduction of testing for biogenic amines in cheese, extension of the range of Nitrogen testing in foods, inclusion of Protein testing and the introduction of flexible scope testing for Sodium and Potassium, allowing the laboratory to add additional matrices following successful validation. In 2016, the flexible scope protocol was again used and lead to additional matrices for Folic Acid determination by LC-MS, being added to our scope of accreditation.

8.3 Proficiency Testing

As part of our external quality control, the laboratory participates in a range of international proficiency testing schemes. Participation in the testing schemes enables the laboratory to monitor the quality of its measurements and can demonstrate our competency to customers and accreditation bodies. During 2015 and 2016, this laboratory participated in a large number of proficiency testing rounds, covering a wide range of parameters, analytical procedures and sample types (see Tables 8.1 to 8.5). The proficiency testing schemes in which we participate include schemes organised by:

- FAPAS: The Food and Environment Research Agency, http://www.fapas.com/
- CHEK: Food and Consumer Product Safety Authority, The Netherlands.
- QDCS: Quality in Dairy Chemistry, Laboratory of the Government Chemist (LGC), U.K.
- FOBS: Campden BRI, UK, Foreign Body Identification Scheme
- AQUACHECK: Proficiency testing scheme for water testing, LGC, U.K. http://www.lgcpt.com
- Pharmassure: Proficiency testing for Pharmaceuticals, LGC, U.K.
- EDQM: European Directorate for the Quality of Medicines and Health Care.
- NMI: National Metrology Institute of Australia.
- LGC: Laboratory of the Government Chemist U.K., Toxicology Scheme https://www.lgcpt.com
- LGC: Cosmetics & toiletries scheme https://www.lgcpt.com

Table 8.1 Proficiency Testing Schemes (Food Testing)

Scheme	Analyte	Sample Type
QDCS	Acid Titration	Milk
FAPAS	Alcoholic Strength	Whiskey
FAPAS	Allergens – Casein	Cake Mix, Infant Soya Formula
FAPAS	Allergens – Egg	Cake Mix
FAPAS	Allergens - Gluten	Oat-based Foodstuff, Cake Mix, Infant Soya Powder
FAPAS	Allergens - Histamine	Canned Fish Sample
FAPAS	Allergens - Peanut	Chocolate Samples
QDCS	Antibiotic Residue (Delvo Test)	Milk
FAPAS	Ash	Canned Meat
QDCS	Fat (Gerber)	Milk
FAPAS	Fat (Werner Schmidt Method)	Canned Meat
FAPAS	Freezing Point Depression (Adulteration)	Milk
National Measurement Institute Australia	Folic Acid	Bread, Flour and Breakfast Cereal Samples
FAPAS	Folic Acid	Breakfast Cereal Samples
FOBS	Microscopy/ Identification of Foreign Objects in Food	2 rounds per year of unknown foreign objects in food
FAPAS	Moisture	Canned Meat Samples
FAPAS	Nutrients - Iron	Breakfast Cereal, Milk Powder, Infant Formula
FAPAS	Nutrients - Magnesium	Breakfast Cereal, Milk Powder, Nutritional Supplement, Infant Formula
FAPAS	Nutrients - Manganese	Milk Powder, Nutritional Supplement, Infant Formula
FAPAS	Nutrients - Zinc	Milk Powder, Breakfast Cereal, Nutritional Supplement
FAPAS	Nutrients - Copper	Nutritional Supplement, Infant Formula
QDCS	Pasteurisation (Alkaline Phosphatase)	Milk
FAPAS	pH	Orange Juice, Soft Drinks, Water Samples
FAPAS	Potassium	Breakfast Cereal, Infant Formula
FAPAS	Preservatives - Benzoic Acid	Soft Drink
FAPAS	Preservatives – Sorbic Acid	Soft Drink
FAPAS	Preservatives – Sulphur Dioxide	Meat, Dried Fruit
FAPAS	Protein (Nitrogen)	Canned Meat Samples
FAPAS	Refractive Index (Soluble Solids as Sucrose)	Orange Juice, Soft Drink
FAPAS	Sodium	Canned Meat, Breakfast Cereal, Cheese & Pasta Meal, Infant Formula Samples
QDCS	Total Solids	Milk, Yoghurt
FAPAS	Trace Metals – Lead	Infant Cereal, Offal, Soya Flour
FAPAS	Trace Metals – Cadium	Infant Formula, Offal, Infant Cereal, Soya Flour, Crab Meat
FAPAS	Trace Metals - Total Arsenic, Mercury	Offal, Soya Flour, Crab Meat
FAPAS	Trace Metals - Chromium, Selenium	Infant Formula, Infant Cereal

Table 8.2 Proficiency Testing Schemes (Water Testing)

Scheme	Analyte	Sample Type
AQUACHECK	Alkalinity, Hardness, Colour, Turbidity, Conductivity, pH, Fluoride, Chlorine, Sulphate, Chloride	Water
AQUACHECK	Nitrate, Nitrite, TON, Ammonia	Water
AQUACHECK	Trace Metals (Antimony, Aluminium, Arsenic, Boron, Cadmium, Chromium, Iron, Manganese, Copper, Lead, Nickel, Selenium, Zinc)	Water
AQUACHECK	Volatile Organic Compounds	Water

Table 8.3 Proficiency Testing Schemes (Pharmaceutical Testing)

Scheme	Analyte	Matrix Tested
EDQM and Pharmassure	Assay & Identification by HPLC	Pharmaceuticals
Pharmassure	Assay & Identification by UV	Pharmaceuticals
Pharmassure	Average Mass & Uniformity of Weight	Pharmaceuticals
Pharmassure	Density	Various Oils (e.g. Caster Oil, Parafin Oil, Cod Liver Oil)
EDQM and Pharmassure	Dissolution	Pharmaceuticals
Pharmassure	Disintegration	Pharmaceuticals
EDQM and Pharmassure	Water Determination- Karl Fischer	Pharmaceuticals
EDQM and Pharmassure	Identification – FT-IR	Pharmaceuticals
EDQM and Pharmassure	Loss on Drying	Pharmaceuticals
Pharmassure	Melting Point	Various Chemicals/ Pharmaceuticals
Pharmassure	Optical Rotation	Fructose
Pharmassure	Physical Measurements	Pharmaceutical Tablets
Pharmassure and Aquacheck Schemes	pH Testing	Various Solutions
EDQM and Pharmassure	Titrations	Various Solutions

Table 8.4 Proficiency Testing Schemes (Toxicology)

Scheme	Analyte and Matrix	Frequency
LGC (Toxicology Scheme)	Alcohol in Blood	Monthly
LGC (Toxicology Scheme)	Alcohol in Urine	Monthly

Table 8.5 Proficiency Testing Schemes (Cosmetics Testing)

Scheme	Analyte	Sample Type
Health Science Authority (HAS)	Trace Elements (Arsenic, Lead, Mercury)	Cosmetic Cream
CHEK	Trace Elements (Lead, Cadmium, Chromium, Nickel, Mercury)	Body Cream
LGC Cosmetics & Toiletries PT Scheme	Trace Elements (Arsenic, Lead, Cadmium, Chromium, Nickel, Mercury)	Lip Gloss, Powder
LGC Cosmetics & Toiletries PT Scheme	Trace Elements (Copper, Zinc,)	Toothpaste
CHEK	Hydrogen Peroxide	Tooth Whitening Gel

9. STAFF TRAINING

The need for staff training and on-going professional development are emphasised in both the Service Contract with FSAI and various specific legislation relating to food control. Both internal and external training is offered to staff in the use of Analytical Methods and Instrumentation (including GC-MS/MS, Ion Chromatography & HPLC), Health & Safety (including Manual Handling & Fire Safety Training) and other training organised by HSE (e.g. Data Protection). In-house induction and HSE induction training is provided for all new staff. General management training has also been undertaken. Due to budgetary constraints staff training has continued to be significantly reduced this year. Most of the staff training received was on a budget neutral basis. Unfortunately, it was not possible to attend other important training courses, which could lead to further improvements and developments in the service, due to the significant expense involved.

10. MEETINGS/COMMITTEES

FSAI: Liaison Meetings with Public Analysts' Group
Service Contract Meetings with Western Area HSE
Allergen Labelling & Analysis Working Group
EHO-PAL Liaison Group
FSAI-EHO-PAL National Group on Sampling Programmes
Molluscan Shellfish Safety Committee
Legislation Committee (FSAI-Dept. of Health & Children…) & Sub-Committees
Bottled Water Guidance Note Drafting Committee
Scientific Sub-committee [Additives, Contaminants…]
LIMS Administrators' Working Group
HSE Regional Food Committee [HSE West]
Cosmetics Control Group HSE and Cosmetics Safety Steering Group (HPRA, HSE…)
OCCL: Organisation of Cosmetics Control Laboratories (EU EDQM)
Zoonoses Committee [Western Region]
Fluoridation Committee [HSE West]
HSE/County Council Water Group Meetings
HSE Water Group Meetings
EPA Air Quality Meetings/Workshops
Chemistry Network of Accredited Laboratories: Forum for Quality Managers from INAB Accredited Chemistry Laboratories
HPRA (formerly known as Irish Medicines Board): Liaison Meetings
EDQM European Network of Official Medicines Control Laboratories: Annual Meeting, CAP meeting, participated as Quality Assurance Auditor in MJA audits, Working Group for Revision of OMCL Guideline.
Community Services' Management Meetings

11. INFORMATION AND COMMUNICATION TECHNOLOGY

The LabWare laboratory information management system (LIMS), funded nationally by safefood has been 'live' since 01 January 2007. In 2008 an electronic reporting link was set-up between this laboratory and the FSAI, using the government VPN (Virtual Private Network), whereby summaries of all relevant sample details and results are automatically created and sent to the FSAI for inclusion in a national database of food testing. Further development of the LIMS was planned in 2010 - 2011 (connection to the EPA Environmental Data Exchange Network (EDEN)) but this project was paused while a new national information technology system for the Environmental Health Services in the HSE is procured. The EHS are currently trialling in-field sample loggers and it is then intended to interface these systems with PAL and OFML LabWare databases.
The VPN described above has experienced issues within the last 12 months which have not yet been fully resolved, at the time of writing, efforts are continuing to resolve these issues.

In late 2016 the laboratory underwent a pre-upgrade assessment with LabWare to determine the investment required to upgrade the current version of LIMS (Version 5) to Version 7. This is required as Version 8 of LabWare is envisaged within 18 months and the effect of this is twofold; Version 5 will no longer be supported by LabWare and it is also a quality requirement to be within two versions of the current software. The assessment indicated that a minimum of 15 days LabWare consultancy and 20 days in-house effort would be required to effect the change. Options for funding and facilitating the upgrade are currently being investigated.

In December 2015/January 2016 the network drives used by the laboratory were moved from their in-house location to a "virtual" location hosted by UCHG. The benefits of this have been apparent; no need to manage daily, weekly and monthly back-ups, more space available for database storage and far less in-house monitoring of systems is required. There has been no impact on response times, no

lag in any of the networked systems has been apparent. In October 2016 one of our off-site servers experienced a ransomware attack and a complete disaster recovery was effected with the assistance of UCHG server support staff and our offsite system backup suppliers. Within 4 days operations were returned to normal, providing confidence in our disaster recovery processes.

Wherever possible, during 2015 and 2016, PCs have been networked to facilitate access to network printers and services. This process is ongoing with the goal of having no standalone printers remaining in the laboratory.

12. GLOSSARY OF ABBREVIATIONS

ADI Acceptable Daily Intake

BfR German Risk Assessment Authority
BIP Border Inspection Posts
BOD Biochemical Oxygen Demand

CAP Centrally Authorised Products
COD Chemical Oxygen Demand
CODEX Codex Alimentarius Commission
COPHES Consortium to Perform Human Bio-Monitoring on a European Scale

DAFM Department of Agriculture, Food and the Marine
DOH Department of Health

EA European co-operation for Accreditation
EDEN Environmental Data Exchange Network
EDQM European Directorate for the Quality of Medicines and HealthCare
EFSA European Food Safety Authority
EHO Environmental Health Officer
EHS Environmental Health Service
ELISA Enzyme-linked immunosorbent assay
EPA Environmental Protection Agency
EQUAS External Quality Assurance Scheme

FSAI Food Safety Authority of Ireland
FSLS Food Safety Laboratory Service

HACCP Hazard Analysis and Critical Control Point
HBM Human Bio-Monitoring
HPLC High Performance Liquid Chromatography
HPRA Health Products Regulatory Authority
HSE Health Service Executive
HVP Hydrolysed Vegetable Protein
IARC International Agency for Research on Cancer
ICIs Inter-laboratory Comparison Investigations
ICP-MS Inductively coupled plasma mass spectrometry
INAB Irish National Accreditation Board
IR Infra-Red

LIMS Laboratory Information Management System
LOD Limit of Detection
LOQ Limit of Quantitation

MJA Mutual Joint Audit
MRP/DCP Mutually Recognised Products/Decentralised Products

NCA National Consumer Agency
NMR Nuclear Magnetic Resonance
NRL National Reference Laboratory
NSAI National Standards Authority of Ireland
NTU Nephelometric Turbidity Units

OCCL Official Cosmetic Control Laboratories
OMCL Official Medicines Control Laboratories

PAL Public Analyst Laboratory
PCCC Primary Continuing and Community Care
PEMSAC Platform of European Market Surveillance Authorities for Cosmetics
PTS Proficiency Testing Schemes

QA Quality Assurance

RAPEX EU Rapid Alert System for Non-Food Products
RASFF EU Rapid Alert System for Food and Feed

safefood safefood, The Food Safety Promotions Board
S.I. Statutory Instrument
SOPs Standard Operating Procedures

THMs Trihalomethanes

UV Ultra-violet

VOCs Volatile Organic Compounds
VWA Food and Consumer Product Safety Authority of The Netherlands

WHO World Health Organisation

XRF X-Ray Fluorescence

Appendix 1 Outline Summary of Food Sampling-Analysis (Chemical) Programme for 2015 HSE West

Jan. 5-16		30 **Various sulphited fruit & veg** (Sulphur dioxide)	**Folic Acid method development Fruit juices**	**GC-MS2 Method dev/validation etc**
Jan. 19-30		35 **Nu-free foods** (Tree nut protein)		
Feb. 2-13	2(x9) **Various Port-level Fish** (Biogenic Amines)	10-15 **Gluten-free beers** (Gluten)	34 **Fortified breads, breakfast cereals, flours** (Folic Acid)	
Feb. 16-27	**Weaning foods** 35 (Folic acid, Na/K, minerals, other nutritional testing, general nutritional labelling)		15 **Fortified spreads & fortified milks** (Folic acid)	
Mar. 2-13			52 **Meat products** (Sulphur dioxide)	90 **FSAI Salt Reduction Programme** (Na & K) Dairy and Non-Dairy Spreads
Mar. 16-27		25 **'Peanut-free' Foods** (Peanut Protein)		
Apr. 1-10	**Health food produce** 24 **-labelled values & low salt or reduced salt foods** (Na & K, labelling, Gen.Exam.etc)	25 **Scombroid fish etc.** (Biogenic Amines)		
Apr. 13-24	**Foods Labelled as** 30 **"Milk-free"** (Milk Protein/Casein etc)	6 **Brine solutions** (Nitrate & Nitrite)		160 **FSAI Salt Reduction Programme** (Sodium & Potassium) Breads
May 1-8	22 **Sea Vegetables** (Metals, Labelling, others)		20 **"Egg-free" Foods** (Egg Protein)	
May 18-22	27 **Scombroid fish etc.** (Biogenic Amines)			
May 25-29		**Infant Formula,** 20 **Follow-on Formula, Premature Infant Formula** (Allergens, Folic Acid, Labelling, minerals.)		
June 08-19	27 **Beers & ciders from Irish Micro breweries** (Sulphites, alcohol, labelling)	1(X9) **Various Port-level Fish** (Biogenic Amines)	16 **Folic Acid Supplements** (Folic acid)	
June 22-30		23 **Bottled waters from manufacturing premises** (Audit suite)		

Appendix 1: Outline Summary of Food Sampling-Analysis (Chemical) Programme for 2015 HSE West (continued)

July 6-17	2(x9) **Various Port-level Fish** (Biogenic Amines)	20 **Raw-milk cheeses from markets** (Biogenic amines)	20 **Foods labelled as shellfish free** (Shellfish protein)	
July 20-31		30 **'Peanut-free' Foods** (Peanut Protein)		150 **FSAI Salt Reduction Programme** (Sodium & Potassium) Breakfast Cereals
Aug. 10-21	3(x9) **Various Port-level Fish** (Biogenic Amines)		~6 **Brine solutions** Nitrate & Nitrite	
Aug. 17-28			**Various Sulphited Foods** 31 (SO_2)	
		Locally manufactured G-F Foods (Gluten) 68		
Sept. 1-11	3(x9) **Various Port-level Fish** (Biogenic Amines)	**Gluten-Free Foods New, mainstream G-F products** 49 (Gluten)	**Imported Body-Building Supplements National Survey** 30 (Proximates, Minerals, Food Irradiation DMAA)	10 **Shellfish – imports etc** Oysters, Mussels, Scallops (AZA, DSP, ASP)
Sept. 15-30	Fruit Juices Composition (sugars etc,)			5-10 **Imported Shellfish** Oysters, Mussels, Scallops (DSP/AZA, ASP, Pb/Cd)
Oct.	20 **Scrombroid fish** (Biogenic amines)		-6 **Brine Solutions** (Sodium Nitrate/Sodium Nitrite)	150 **FSAI Salt Reduction Programme** (Sodium & Potassium) Processed Meats
Oct. 12-23		**Irish Manufacturers Food supplements** 50 (Folic acid, Minerals, Irradiation)		
Nov. 9-20	1(x9) **Various Port-level Fish** (Biogenic Amines)	**Fruit Juices, juice-based drinks etc** 20 (Folic acid, Compositional, RI/Sugars)	**Locally Manufactured produce Gluten-free Foods** 35 (Gluten, Labelling etc)	
Nov. 23-30			**Ethnic Foods** 36 (General Exam., Na & K & labelling…)	
Dec. 7-11	2(x9) **Various Port-level Fish** (Biogenic Amines)	**New labelling law. Loose or takeaway /catering Foods labelled "Peanut-free"** 30 (Peanut Protein)	49 **Christmas Foods etc** (Na & K, General Exam'n & Labelling)	
Dec. 15-24	**Food Complaints, Food 'Alerts' etc., 'suspect' samples, Follow-up samples etc**			
Jan - Dec	**BOTTLED WATERS from manufacturing premises - CHECK or AUDIT suite - approx 97 samples - HSE west production.**			
Jan - Dec	**- Non-programmed samples - Food Complaints, Food 'Alerts' etc., 'suspect' samples and tap waters from food premises (where relevant) - 'Inspection Support' samples from Manufacturing/ Processing etc. premises when required, and in consultation with lab.**			

Appendix 1: Outline Summary of Food Sampling-Analysis (Chemical) Programme for 2016 HSE West

Jan. 4-15		30 **Various sulphited fruit & veg** (Sulphur dioxide)		
Jan. 18-29	35 **Weaning Foods** (Na, K, Minerals)			
Feb. 1-28				150 **FSAI Salt Reduction Programme** (Sodium & Potassium)
Feb. 1-12	2 (x 9) **Various Port-level Fish** (Biogenic amines)	20 **Gluten free beers** (Gluten)	23 **Fortified breads, breakfast cereals** (Folic acid)	
Feb. 15-26	15 **Fortified spreads, fortified milks** (Folic acid)	24 **Health Food Produce & Low salt or reduced salt foods** (Sodium, potassium, labelling)		
Mar. 1-11			43 **Meat products** (Sulphur dioxide)	
Mar. 21-31		25 **'Peanut-free' Foods** (Peanut Protein)		
Apr. 4-8	35 **Foods Labelled as "Milk-free"** (Casein)		6 **Brine solutions** (Nitrate & Nitrite)	
Apr. 18-22		144 **Bottled waters from manufacturing premises** (Audit suite)	25 **Scrombroid Fish** (Biogenic amines)	
May 2-13	20 **Sea Vegetables** (Metals, Labelling, others)		20 **"Egg-free" Foods** (Egg Protein)	
May 16-20	26 **Scombroid fish etc.** (Biogenic Amines)	20 **Infant Formula, Follow on Formula, Premature Infant Formula** (Folic acid, gluten, Na, K)	42 **Locally manufactured Foods** (Gluten, peanut)	
June 06-17	31 **Beers & ciders from Irish Micro breweries** (Sulphites, alcohol, labelling,)	18 **Raw Milk Cheese** (Biogenic Amines)	24 **Food Supplements** (Folic acid)	
June 14	1(x 9) **Various Port-level Fish** (Biogenic amines)			

Appendix 1: Outline Summary of Food Sampling-Analysis (Chemical) Programme for 2016 HSE West (continued)

July 1-31				150 **FSAI Salt Reduction Programme** (Sodium & Potassium) Breakfast Cereals
July 18-29		28 **'Gluten-free' or 'Peanut-free' Foods** (Gluten/Peanut Protein)		
Aug. 8-12	3(x9) **Various Port-level Fish** (Biogenic Amines)		~6 **Brine solutions** Nitrate & Nitrite	
Aug. 22-31		50 **Locally manufactured G-F Foods** (Gluten)	31 **Various Sulphited Foods** (SO_2)	
Sept. 1-09	2(x9) **Various Port-level Fish** (Biogenic Amines)		28 **Imported Body-Building Supplements National Survey** (Proximates, Minerals, Food Irradiation, DMAA)	12 **Shellfish – imports etc** Oysters, Mussels, Scallops (AZA, DSP, ASP)
Sept. 19-30		33 **Gluten-Free Foods New, mainstream G-F products** (Gluten)		3 **Imported Shellfish** Oysters, Mussels, Scallops (DSP/AZA, ASP, Pb/Cd)
Oct. 3-14	20 **Scrombroid fish** (Biogenic amines)		-6 **Brine Solutions** (Sodium Nitrate/Sodium Nitrite)	150 **FSAI Salt Reduction Programme** (Sodium & Potassium)
Oct. 17-28	36 **Ethnic Foods** (General Exam., Na, K & labelling)	50 **Irish Manufacturers Food supplements** (Folic acid, Minerals, Irradiation)		
Nov. 7-18			39 **Locally Manufactured produce Gluten-free Foods** (Gluten, Labelling etc)	
Nov. 21-30	30 **Christmas Foods etc.** (Na & K, General Exam'n & Labelling)			
Dec. 6-11	2(x9) **Various Port-level Fish** (Biogenic Amines)			
Dec. 15-24	**Food Complaints, Food 'Alerts' etc., 'suspect' samples, Follow-up samples etc**			
Jan-Dec	**BOTTLED WATERS from manufacturing premises - CHECK or AUDIT suite - approx 144 samples - HSE west production.**			
Jan-Dec	**-Non-programmed samples - Food Complaints, Food 'Alerts' etc., 'suspect' samples and tap waters from food premises (where relevant) - 'Inspection Support' samples from Manufacturing/ Processing etc. premises when required, and in consultation with lab.**			

Appendix 2: Routine Official samples (excluding follow-up samples) received from H.S.E., for the period from 01/01/2015 to 31/12/2015

Appendix 2: Food Complaint samples (from H.S.E. & the Public) from 01/01/2015 to 31/12/2015

Food Category	No. of Samples with Infringements		Chemical / Physical Contamination		Compositional		Labelling (1) & Presentation		Other		No. of Samples Received		% with infringements	
	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint
1. Dairy Products	10	4	0	3	4	1	6	0	0	0	56	6	17.86	66.67
2. Egg and Egg Products	0	1	0	1	0	0	0	0	0	0	0	1	N/A	100.00
3. Meat and Meat Products, Game and Poultry	3	6	0	4	2	2	1	0	0	0	68	15	4.41	40.00
4. Fish, Shellfish and Molluscs	7	1	2	1	0	0	5	0	0	0	92	2	7.61	50.00
5. Fats and Oils	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
6. Soups, Broths and Sauces	8	1	0	0	0	1	8	0	0	0	32	4	25.00	25.00
7. Cereals & Bakery Products	22	14	1	4	5	3	16	7	0	0	128	35	17.19	40.00
8. Fruit and Vegetables	13	5	0	4	7	1	6	0	0	0	54	9	24.07	55.56
9. Herbs and Spices	3	0	0	0	0	0	3	0	0	0	10	1	30.00	0.00
10 Non-Alcoholic Beverages	10	2	0	0	0	2	10	0	0	0	218	9	4.59	22.22
11 Wine	0	0	0	0	0	0	0	0	0	0	2	0	0.00	N/A
12 Alcoholic Beverages (Other than Wine)	5	0	0	0	0	0	5	0	0	0	40	1	12.50	0.00
13 Ices and Desserts	1	0	0	0	0	0	1	0	0	0	5	0	20.00	N/A
14 Cocoa and Cocoa Preparations, Coffee & Tea	5	0	0	0	0	0	5	0	0	0	12	0	41.67	N/A
15 Confectionery	5	3	0	3	0	0	5	0	0	0	61	4	8.20	75.00
16 Nuts & Nut Products, Snacks	3	2	0	2	1	0	2	0	0	0	32	2	9.38	100.00
17 Prepared Dishes	8	8	0	7	1	1	7	0	0	0	35	14	22.86	57.14
18 Foodstuffs Intended For Special Nutritional Uses	11	0	0	0	3	0	8	0	0	0	185	17	5.95	0.00
19 Additives	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
20 Materials & Articles Intended to come into contact with Foodstuffs	0	1	0	0	0	1	0	0	0	0	1	2	0.00	50.00
21 Others	36	4	0	3	5	0	31	1	0	0	95	14	37.89	28.57
Totals	**150**	**52**	**3**	**32**	**28**	**12**	**119**	**8**	**0**	**0**	**1126**	**136**	**13.32**	**38.24**

Note 1: Refers to labelling infringements under the Dept. of Health enacted legislation only

Appendix 2: Routine Official samples (excluding follow-up samples) received from H.S.E., for the period from 01/01/2016 to 31/12/2016

Appendix 2: Food Complaint samples (from H.S.E. & the Public) from 01/01/2016 to 31/12/2016

Food Category	No. of Samples with Infringements		Chemical / Physical Contamination		Compositional		Labelling (1) & Presentation		Other		No. of Samples Received		% with infringements	
	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint	Routine	Complaint
1. Dairy Products	11	2	0	1	0	1	11	0	0	0	45	3	24.44	66.66
2. Egg and Egg Products	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
3. Meat and Meat Products, Game and Poultry	7	9	0	5	1	3	6	1	0	0	49	15	14.29	60.00
4. Fish, Shellfish and Molluscs	3	1	1	0	0	1	2	0	0	0	81	4	3.70	25.00
5. Fats and Oils	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
6. Soups, Broths and Sauces	12	0	0	0	0	0	12	0	0	0	32	1	37.50	0.00
7. Cereals & Bakery Products	28	13	0	13	0	0	28	0	0	0	103	19	27.18	68.42
8. Fruit and Vegetables	5	3	0	3	4	0	1	0	0	0	34	4	14.71	75.00
9. Herbs and Spices	2	3	0	2	0	1	2	0	0	0	5	4	40.00	75.00
10 Non-Alcoholic Beverages	11	7	0	3	1	4	10	0	0	0	151	10	7.28	70.00
11 Wine	0	0	0	0	0	0	0	0	0	0	4	1	0.00	0.00
12 Alcoholic Beverages (Other than Wine)	0	0	0	0	0	0	0	0	0	0	45	5	0.00	0.00
13 Ices and Desserts	0	0	0	0	0	0	0	0	0	0	2	0	0.00	N/A
14 Cocoa and Cocoa Preparations, Coffee & Tea	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
15 Confectionery	0	0	0	0	0	0	0	0	0	0	33	4	0.00	0.00
16 Nuts & Nut Products, Snacks	7	0	0	0	0	0	7	0	0	0	16	6	43.75	0.00
17 Prepared Dishes	4	10	0	8	1	1	3	1	0	0	12	14	33.33	71.43
18 Foodstuffs Intended For Special Nutritional Uses	7	1	0	1	5	0	2	0	0	0	232	2	3.02	50.00
19 Additives	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
20 Materials & Articles Intended to come into contact with Foodstuffs	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A
21 Others	6	7	0	6	1	1	5	0	0	0	42	13	14.29	53.85
Totals	**103**	**56**	**1**	**42**	**13**	**12**	**89**	**2**	**0**	**0**	**886**	**105**	**11.63**	**53.33**

Note 1: Refers to labelling infringements under the Dept. of Health enacted legislation only

Appendix 3: Outline of Principal Official Surveillance of Foodstuffs in Ireland (ROI).

Department/Agency Authority	Principal Food Categories	Principal Sampling Stage(s)	Principal Sampling Officers	Principal Official Laboratories[1]	Test Parameters and Groups
Department of Agriculture Food & the Marine (DAFM)	Foods of Animal Origin (Meats, etc.) Fruit/Vegetables, etc. Milk/Dairy, etc. Fish, Shellfish, etc.	'Production' Meat Plants, Farms, etc. Dairy Plants, etc. Fishing Boats, Processing plants, Fish Farms, etc.	DAFM Veterinary Officers & Agricultural Officers, etc. Sea Fishery Officers etc. (Sea Fisheries Protection Authority (SFPA))	Veterinary Public Health Regulatory Laboratory Ashtown Food Research Centre Labs State Laboratory Pesticides Laboratory Dairy Science Labs Marine Institute (also BIM Lab)	Microbiology & Veterinary Residues, Contaminants, etc. Pesticides, Microbiology, Residues etc., Microbiology (incl. virology), Marine Biotoxins, Residues & Contaminants etc.
Health Service Executive (HSE)	All foodstuffs (Food, Drink, Food-contact Materials)	All stages Manufacturing, wholesale, Retail, Catering, Import etc.	HSE Environmental Health Officers (EHOs)	HSE Food Microbiology Labs & **HSE Public Analysts' Labs[2]**	Microbiology Contaminants, Complaints, Food Allergens, Additives, Nutritional, Labelling, etc.
Local Authorities	Meat, Dairy, Brines....	'Production' plants, etc.	Veterinary Officers, etc.	Local Authority Labs, Dept. of Agriculture Labs, etc.	Microbiology, Residues, etc.
Radiological Protection Institute of Ireland (RPII)	Marine products, Meats, Others	Various	Various	Radiological Protection Institute of Ireland	Ionising Radiation
FSAI (surveys)	Miscellaneous Foodstuffs	Various	FSAI, etc.	Various	Various

[1] Testing on behalf of DAFM is also performed by some other labs (e.g.: the Irish Equine Centre, Central Veterinary Research Laboratory, etc), - see Directory of Food Safety Laboratory Services, Safefood, for more details on food testing labs in Ireland.

*[2] **The Public Analysts' Laboratory Service (PALS)** operates as a single, co-ordinated service (food chemical testing) within the HSE, with a system of national Specialisations and Core Testing in place (and ongoing). A Service is provided to HSE largely, but also to FSAI, SFPA, DAFM…*

***Core Testing:** Microscopy/Complaints; General Examination/Labelling etc.*

*Examples of **Specialisations** include:*

***Dublin PAL:** Mycotoxins and Plant Toxins; Food Contact Materials; Food Processing Contaminants; Sweeteners, Anti-oxidants & Flavourings; Honey (Authenticity & Quality etc).*

***Cork PAL:** Heavy Metals; Vitamins & Other Nutritional testing; GMO Testing; Food Fraud/Adulteration; Food Irradiation screening; Pesticides (Bottled Waters & Infant Formulae..);*

***Galway PAL:** Food Allergens; 'Salt' (Na/K), Sugars – FSAI national re-formulation programmes, etc; Folic Acid & Nutrient Minerals etc; VOCs in Drinking & Bottled Waters; Natural Contaminants (Biogenic amines….).*

Appendix 4: Annual Results Summary for Food Contaminants etc. PAL Galway (results for all foods tested)

	Non-complying or "Excessive" Samples/Total Samples tested										
Parameter	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Aflatoxins	13/220 5.9%	8/220 3.6%	1/149 0.7%	3/115 2.6%	0/49 0%	1/26 3.8%	N/T	N/T	N/T	N/T	N/T
Fumonisins	0/51 0%	0/24 0%	1/10 10.0%	3/40 7.5%	0/21 0%	N/T	N/T	N/T	N/T	N/T	N/T
Lead (Pb)	1/143 0.7%	2/479 0.4%	2/512 0.4%	4/422 0.9%	0/390 0%	0/207 0%	0/128 0%	0/375 0%	0/128 0%	0/89 0%	0/45 0%
Cadmium (Cd)	0/130 0%	2/403 0.5%	0/512 0%	1/415 0.2%	4/381 1.0%	0/204 0%	0/129 0%	0/375 0%	2/126 1.6%	0/90 0%	0/81 0%
Mercury (Hg)	0/74 0%	0/54 0%	0/20 0%	4/169 2.4%	2/233 0.9%	0/38 0%	0/80 0%	0/105 0%	0/89 0%	0/5 0%	0/1 0%
Arsenic (As)	0/47 0%	0/163 0%	0/238 0%	0/51 0%	0/67 0%	0/7 0%	0/34 0%	0/366 0%	0/130 0%	0/89 0%	0/81 0%
Benzo-[a]-pyrene	2/98 2.0%	19/102 18.6%	0/115 0%	0/65 0%	0/57 0%	N/T	N/T	N/T	N/T	N/T	N/T
3-MCPD	2/73 2.7%	0/96 0%	0/30 0%	N/T	0/18 0%	0/33 0%	N/T	N/T	N/T	N/T	N/T
Nitrates	0/39 0%	0/35 0%	0/3 0%	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Marine Biotoxins: DSPs	0/21 0%	0/11 0%	0/20 0%	1/22 4.5%	0/14 0%	0/15 0%	0/13 0%	0/17 0%	0/11 0%	0/8 0%	0/13 0%
AZAs	0/20 0%	0/29 0%	0/20 0%	1/23 4.3%	0/14 0%	0/8 0%	0/13 0%	0/17 0%	0/11 0%	0/8 0%	0/13 0%
ASPs	0/23 0%	0/39 0%	0/36 0%	0/30 0%	0/30 0%	0/18 0%	0/15 0%	0/17 0%	0/11 0%	0/8 0%	0/13 0%
Gluten Gluten Free (GF) Foods	4/144 2.8%	1/175 0.6%	2/102 2.0%	17/394 4.3%	4/333 1.2%	6/270 2.2%	8/476 1.7%	34/631 5.4%	52/761 6.8%	6/1059 0.6%	5/345 1.4%
Lactose	New testing introduced in 2012						0/67 0%	0/25 0%	0/15 0%	N/T	N/T
Casein	New testing introduced in 2012						0/27 0%	1/35 2.9%	16/68 23.5%	4/52 7.7%	1/12 8.3%
Soya	New testing introduced in 2012						1/32 3.1%	N/T	N/T	N/T	N/T
Peanut	Testing introduced in 2010				0/169 0%	0/34 0%	0/113 0%	1/78 6.4%	0/104 0%	0/88 0%	1/54 1.9%
Egg	New testing introduced in 2013							3/47 6.4%	2/41 4.9%	0/24 0%	0/23 0%
Hazelnut	New testing introduced in 2015									1/32 3.1%	N/T
Pecan	New testing introduced in 2015									0/1 0%	N/T
Benzene	3/90 3.3%	0/64 0%	0/29 0%	0/58 0%	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Anti-bacterial Substances (ABS) EC 4-Plate Test	0/38 0%	0/37 0%	0/38 0%	0/51 0%	0/32 0%	0/24 0%	0/20 0%	0/16 0%	0/20 0%	N/T	N/T
AV/DPTGs(Oils)	2/17 11.8%	9/32 28.1%	5/27* (18.5%)	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Histamine/ Biogenic Amines	4/139 2.9%	16/131 12.2%	2/128 1.6%	15/320 4.7%	5/289 1.7%	1/218 0.5%	5/204 2.5%	3/94 3.2%	3/75 4.0%	2/109 1.8%	1/97 1.0%
Sorbates/ Benzoates	2/36 5.6%	2/59 3.4%	6/72 8.3%	0/47 0%	0/34 0%	N/T	N/T	N/T	N/T	N/T	N/T
Sulphites	6/198 3.0%	1/166 0.6%	8/190 4.2%	8/206 3.9%	9/213 4.2%	6/176 3.4%	15/160 9.4%	26/195 13.3%	17/170 10%	13/170 7.6%	11/149 7.4%
Nitrites / Nitrates	13/85 15.3%	11/94 11.7%	2/64 3.1%	0/8 0%	4/32 12.5%	25/79 31.6%	7/86 8.1%	14/112 12.5%	6/56 10.7%	0/13 0.0%	0/7 0.0%
Artificial Sweeteners (i.e. Acesu-lfame K, Aspartame & Saccharin)	0/38 0%	N/T	0/41 0%	0/3 0%	N/T	N/T	N/T	N/T	NT	N/T	N/T
Food Irradiation	3/291 1.0%	2/335 0.6%	0/253 0%	2/136 1.5%	0/56 0%	0/88 0%	0/55 0%	2/71 2.8%	1/93 1.1%	1/76 1.3%	0/29 0%
Food Complaints	77/122 63.1%	77/129 59.7%	69/126 54.8%	50/100 50%	64/105 61.0%	62/122 50.8%	85/139 61.2%	51/97 52.6%	59/137 43.1%	52/136 38%	56/105 53%

N/T: Not tested, ie discontinued/postponed etc.

** Results exceed Dutch DPTGs limit of 15% or Acid value of 4.0 (results not designated as non-complying)*

Appendix 5: Fluoridation of Water Supplies – HSE West for 2015 &2016

FLUORIDATION OF WATER SUPPLIES :- GALWAY

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Ballinasloe	23	0.5-0.7	0.6
Carna	24	0.1-0.7	0.7
Clifden	24	0.1-1.0	0.6
Dunmore/Glenamaddy	24	0.6-0.7	0.6
Galway City	223	0.1-0.8	0.7
Kinvara	23	0.5-1.0	0.7
Luimnagh	70	0.5-0.7	0.7
Mid-Galway Regional	22	0.1-0.7	0.7
Mountbellew	23	0.6-0.7	0.7
Oughterard	24	0.5-0.8	0.7
Portumna	20	0.6-0.7	0.6
Spiddal	25	0.5-0.8	0.6

FLUORIDATION OF WATER SUPPLIES :- MAYO

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Achill	25	0.6-0.9	0.7
Ballina	49	0.5-0.8	0.7
Erris	25	0.6-0.7	0.6
Kiltimagh	23	0.5-0.9	0.7
Lough Mask Regional	50	0.6-0.9	0.7
Shrule	6	0.6-0.7	0.7
Swinford	24	0.1-0.8	0.7
Westport	25	0.6-0.8	0.7

FLUORIDATION OF WATER SUPPLIES :- ROSCOMMON

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Ballinlough Loughglynn	20	0.2-0.8	0.7
Boyle	24	0.5-0.8	0.6
Castlerea Regional	15	0.6-0.8	0.7
Castlerea Urban	25	0.6-0.8	0.7
Mount Talbot	22	0.1-0.7	0.7
North East Regional	24	0.1-0.9	0.7
North Roscommon Regional	24	0.2-0.9	0.7
Roscommon Town (Central)	24	0.1-0.9	0.7
South Roscommon Regional	25	0.5-0.8	0.7
Arigna	15	0.6-1.0	0.7

Appendix 5: Fluoridation of Water Supplies – HSE West for 2015 &2016

FLUORIDATION OF WATER SUPPLIES :- DONEGAL

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Buncrana	26	0.1-0.7	0.6
Bundoran	35	0.1-4.42	0.1
Cardonagh Mixed	39	0.6-0.7	0.7
Cranford	26	0.1-0.8	0.7
Creeslough/Dunfanaghy	33	0.3-0.7	0.7
Donegal/River Eske	41	0.6-0.7	0.7
Falcarragh/Gortahork	28	0.1-0.7	0.1
Frosses/Inver	25	0.1-0.7	0.1
Glenties/Ardara	28	0.1	0.1
Inishowen East	27	0.1-0.7	0.1
Letterkenny	82	0.1-0.7	0.7
Lettermacward	29	0.1-0.8	0.7
Lough Mourne	31	0.1-0.7	0.6
Milford	31	0.6-0.7	0.7
Rosses Regional	41	0.1	0.1

FLUORIDATION OF WATER SUPPLIES :- SLIGO/LEITRIM

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Kinsellagh	23	0.6-0.7	0.7
Lough Gill/ Cairnes	24	0.6-0.7	0.6
Lough Easkey	24	0.6-0.7	0.7
Lough Talt	25	0.1-0.7	0.6
North Leitrim Regional	24	0.1-0.7	0.7
South Leitrim Regional	24	0.5-0.8	0.7
North Sligo Regional Supply	24	0.7-0.8	0.8
South Sligo Regional	25	0.6-0.9	0.7
Killaraght	24	0.5-0.8	0.6
Lough Gill/ Foxes Den	24	0.6-0.7	0.6
Kinlough Tullaghan	24	0.6-0.8	0.7

Appendix 5: Fluoridation of Water Supplies – HSE West for 2015 &2016

FLUORIDATION OF WATER SUPPLIES :- LIMERICK

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Limerick City	40	0.6-0.7	0.7
Clareville	23	0.6-0.7	0.7

FLUORIDATION OF WATER SUPPLIES :- CLARE

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Ennis	26	0.1-0.8	0.7
Ennistymon	26	0.5-0.8	0.7
Kildysart	26	0.3-0.9	0.7
Rockmount	10	0.5-0.8	0.7
Shannon	14	0.3-0.7	0.6
West Clare New Doolough	22	0.6-0.7	0.7
West Clare Old Doolough	25	0.3-0.8	0.7
Milltown Malbay	17	0.4-1.2	0.7
Shannon Sixmilebridge	15	0.6-0.8	0.6

FLUORIDATION OF WATER SUPPLIES :- NORTH TIPPERARY

Location	Number of Samples	Range (mg/L)	Median (mg/L)
Borrisokane	23	0.6-0.7	0.6
Murroe	9	0.1	0.1
Nenagh	35	0.1-0.6	0.5
Newport	21	0.1-0.3	0.1
Roscrea	24	0.2-0.7	0.6
Thurles	48	0.1-0.7	0.6
Templemore	25	0.1-0.7	0.6

Appendix 6A:

Appendix 6A: Concentration of Black Smoke (µg/m³) in the atmosphere during 2015 and 2016 at the junction formerly known as the 'Bodkin Roundabout'.

	Micrograms Per Cubic Metre					
	2015			2016		
	Average Reading	Highest Reading	Lowest Reading	Average Reading	Highest Reading	Lowest Reading
January	2	8	1	2	6	1
February	2	8	1	3	8	1
March	3	10	1	5	11	1
April	4	10	1	2	8	1
May	2	10	1	3	23	1
June	2	6	1	2	6	1
July	1	3	1	1	3	1
August	1	1	1	3	7	1
September	2	6	1	2	8	1
October	5	10	1	7	18	1
November	2	11	1	5	31	1
December	3	11	1	3	18	1
Average	2	8	1	3	12	1

Appendix 6B:

Appendix 6B: Concentration of Sulphur Dioxide (µg/m³) in the atmosphere during 2015 and 2016 at the junction formerly known as the 'Bodkin Roundabout'.

	Micrograms Per Cubic Metre					
	2015			2016		
	Average Reading	Highest Reading	Lowest Reading	Average Reading	Highest Reading	Lowest Reading
January	47	84	17	17	62	3
February	27	61	8	12	32	4
March	21	59	5	21	32	11
April	21	43	7	26	72	3
May	16	65	5	19	29	3
June	41	72	8	26	74	3
July	39	80	5	22	44	6
August	52	60	44	13	23	3
September	25	61	1	10	20	1
October	27	58	2	12	27	3
November	28	63	5	14	36	6
December	18	50	5	10	18	4
Average	30	63	9	17	39	4

Appendix 6C:

Appendix 6C: Daily PM_{10} RESULTS MASS CONCENTRATION (M.C.) µg/m³ for 2015 at the junction formerly known as the 'Bodkin Roundabout'.

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
01	-	38.5	-	-	7.9	-	12.6	14.5	7.3	24.3	23.4	24.7
02	20.4	51.7	-	-	11.7	-	9.7	8.6	5.8	26.7	24.7	23.8
03	25.9	12.8	-	-	16.1	-	12.7	17.8	10.8	42.3	30.8	21.6
04	10.4	19.5	-	-	6.1	-	13.4	18.8	5.7	34.5	35.1	27.3
05	<5	24.1	-	-	7.6	-	9.5	5.8	16.1	24.5	15.1	18.7
06	15.9	16.9	-	-	11.8	-	10.0	8.7	11.0	12.9	13.9	25.6
07	-	15.8	-	-	12.3	-	9.3	21.3	11.6	15.1	10.3	32.1
08	16.7	11.5	-	-	8.4	-	10.4	9.6	24.9	12.4	15.4	13.4
09	24.9	14.6	-	-	13.7	-	10.8	7.8	23.5	16.2	14.7	23.5
10	10.9	20.2	-	-	24.0	-	12.1	8.2	25.0	22.6	12.0	14.5
11	20.3	25.2	-	-	18.0	-	12.9	5.1	16.5	15.9	14.1	16.7
12	25.0	21.5	-	-	18.0	12.7	11.2	9.1	7.1	10.7	17.8	14.7
13	8.4	10.7	-	-	14.8	7.3	8.0	10.9	10.9	18.4	10.8	<5
14	13.4	26.5	-	-	13.3	7.6	11.9	9.2	9.9	18.6	15.8	7.9
15	27.6	16.0	-	-	-	9.3	9.8	17.3	10.5	23.2	15.5	30.6
16	11.9	11.4	-	-	18.8	8.5	12.7	18.3	8.3	28.0	12.8	9.9
17	12.5	18.6	-	-	14.7	9.2	15.9	31.3	8.7	22.0	14.4	<5
18	13.7	15.6	-	-	9.7	15.1	9.8	7.8	10.7	17.6	19.4	13.4
19	18.0	19.3	-	-	8.0	8.5	6.3	5.6	14.0	16.0	10.7	17.0
20	10.1	7.8	-	-	21.1	10.5	13.7	<5	6.7	9.9	7.5	15.1
21	20.2	14.4	-	-	11.0	9.3	15.8	16.0	-	10.1	10.4	59.1
22	29.3	15.4	-	-	<5	8.3	31.0	10.5	8.5	17.5	14.4	19.8
23	7.1	16.5	-	-	<5	9.3	38.5	5.9	11.8	-	15.0	-
24	20.8	-	-	-	13.7	10.5	6.1	12.6	29.3	9.8	12.5	11.6
25	10.5	-	-	-	<5	14.8	6.0	11.7	19.0	12.0	22.5	21.7
26	13.4	-	-	-	-	20.7	5.8	9.1	36.5	10.4	5.7	-
27	8.1	-	-	-	14.0	17.3	6.7	14.0	23.7	14.2	9.0	-
28	10.9	-	-	-	9.6	20.8	7.5	10.8	25.3	17.0	15.1	29.3
29	9.8	-	-	-	6.5	16.8	9.0	9.5	28.6	21.9	27.8	7.9
30	9.6	-	-	-	12.0	9.8	5.8	7.2	30.2	12.7	15.6	20.7
31	11.8	-	-	-	30.4		8.4	5.9		16.5		10.6
Monthly Mean	**16**	**19**	**-**	**-**	**13**	**12**	**12**	**12**	**16**	**18**	**16**	**20**
No. of Days exceeding 50µg/m³	**0**	**1**	**-**	**-**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**

Appendix 6D:

Appendix 6D: Daily PM_{10} RESULTS MASS CONCENTRATION (M.C.) µg/m³ for 2016 at the junction formerly known as the 'Bodkin Roundabout'.

Day	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
01	10.0	41.4	10.5	9.3	10.2	12.0	12.0	8.1	7.9	-	14.1	42.7
02	9.2	16.3	11.3	17.9	-	16.1	12.3	7.8	13.6	-	16.5	42.1
03	9.1	19.0	10.8	11.6	17.0	17.8	7.7	13.7	11.8	-	8.3	27.3
04	9.0	11.4	9.5	12.4	17.1	19.7	8.8	8.1	5.2	-	6.6	22.2
05	-	10.5	8.3	11.8	18.7	20.3	8.6	9.1	9.6	-	6.3	38.8
06	11.5	11.0	10.8	14.2	14.8	18.4	9.3	12.2	<5	-	6.2	12.1
07	10.1	17.7	10.6	8.8	16.1	19.6	10.0	21.1	9.3	-	24.0	12.9
08	14.9	13.2	20.5	10.5	23.2	20.7	16.3	16.6	9.8	-	8.5	15.4
09	22.9	8.3	10.6	6.8	41.7	14.6	14.2	11.1	9.7	-	8.2	23.7
10	9.2	19.8	30.7	12.9	34.3	9.2	8.1	11.6	11.5	9.3	27.9	22.3
11	7.8	22.1	16.4	15.3	28.5	7.3	11.5	12.4	10.6	14.8	9.0	13.9
12	19.1	19.8	16.8	16.7	29.8	7.7	10.1	13.2	8.5	14.2	8.8	16.5
13	9.6	16.6	17.4	14.4	21.2	6.3	13.2	7.1	13.0	13.8	16.6	8.0
14	9.4	14.4	30.5	15.1	15.2	9.6	8.5	8.0	7.7	19.8	<5	23.6
15	21.9	15.9	29.1	9.4	11.7	12.2	11.2	10.7	6.6	12.1	9.3	23.5
16	36.3	11.0	22.4	9.0	16.2	16.1	9.4	20.1	8.8	5.4	13.7	42.0
17	13.8	10.7	30.7	10.1	12.2	13.7	13.4	17.2	12.7	8.0	<5	22.4
18	22.0	12.0	43.0	9.9	-	10.1	36.8	14.2	6.6	55.1	5.8	16.7
19	22.2	10.8	25.6	40.5	-	7.0	51.2	12.4	7.5	13.4	19.0	47.0
20	21.9	13.2	22.1	25.4	<5	9.9	9.0	6.6	9.0	-	23.1	18.3
21	7.5	7.2	14.1	24.9	8.9	16.3	11.0	9.4	10.2	15.4	7.3	16.8
22	27.5	16.0	30.1	21.5	7.5	24.6	24.6	10.1	11.2	18.4	6.6	14.3
23	20.0	26.3	21.3	10.0	13.2	16.3	16.3	8.8	-	14.4	20.5	17.4
24	9.2	22.5	17.6	6.6	13.5	21.3	10.3	9.4	-	14.4	18.1	25.9
25	12.7	24.1	19.8	10.5	18.8	10.0	8.3	9.0	-	16.6	22.8	21.1
26	16.9	8.3	8.6	18.0	20.9	5.5	8.1	10.5	-	8.1	-	15.1
27	8.7	31.7	14.9	8.5	13.6	17.3	5.9	11.4	-	9.3	21.4	21.1
28	20.8	32.4	7.6	10.0	18.0	11.2	8.8	7.9	-	5.9	29.8	19.5
29	28.3	12.8	10.5	7.9	14.1	8.8	10.3	8.7	-	12.2	34.4	19.4
30	13.2		8.5	12.8	10.1	8.6	6.1	10.9	-	14.7	55.4	22.6
31	16.2		13.9		10.0		5.8	15.8		16.1		14.7
Monthly Mean	**15**	**17**	**18**	**14**	**17**	**14**	**13**	**11**	**7**	**11**	**16**	**23**
No. of Days exceeding 50µg/m³	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**

Appendix 7:

Extract from National Cosmetics Surveillance Programme (PAL Galway testing) 2015

Period - 2015	Survey/Samples	Number of Samples	Chemical Test Parameter(s)
Feb 23rd-27th	Low cost, leave-on produce (e.g. St. Patricks Day Produce)	20	Allergenic/Heavy Metals: (Hg, Pb, Cd, Cr, Ni, As)
Mar 23rd-27th	Tooth-whitening products	30	Hydrogen Peroxide and Boron Compounds
Aug 10th -15th	Hair Dyes (Black Henna Hair Products)	20	p-Phenylenediamine & Oxidation Colorants
Sept 1st-4th	Low-Cost Toothpastes	25	Fluoride
Sept 28th-Oct 2nd	Children's Make-up sets & Face Paints	20	Allergenic/Heavy Metals
Oct 19th-23rd	'Preservative -free' Children's cosmetics for dry skin and 'Organic' products	20	Preservatives: Formaldehyde & Sulphites
Nov 9th-13th	Miscellaneous Irish-manufactured Cosmetics	25	Formaldehyde, Labelling & Allergenic/Heavy Metals
January - December	**General: Non-routine samples (Complaints, RAPEX etc.); Method development work etc. ongoing.**		

Extract from National Cosmetics Surveillance Programme (PAL Galway testing) for 2016

Period - 2016	Survey/Samples	Number of Samples	Chemical Test Parameter(s)
Feb 22nd-26th	Low-cost, Leave-on Products, inc. St Patrick's Day Products	8	Allergenic/Heavy Metals: (Hg, Pb, Cd, Cr, Ni, As)
	'Kids' cosmetics (marketed as Toys)	12	Metals, Labelling
Apr 4th-15th	Tooth-whitening products	20	Hydrogen Peroxide and Boron Compounds
June 6th-17th	Hair Dyes (Black Henna Hair Products)	20	p-Phenylenediamine, Oxidation Colorants & Labelling review
Oct 3rd-14th	Children's Halloween Face Paints	10	Allergenic/Heavy Metals: (Hg, Pb, Cd, Cr, Ni, As)
	'Kids' Cosmetics (marketed as Toys)	10	Allergenic/Heavy Metals: (Hg, Pb, Cd, Cr, Ni, As)
Oct 17th-21st	'Preservative -free' Children's cosmetics for dry skin and 'Organic' products	20	Preservatives: Formaldehyde & Sulphites
Nov 7th-18th	Miscellaneous Irish-Manufactured Cosmetics	20	Formaldehyde, Labelling & Allergenic/Heavy Metals
January - December	**General: Non-routine samples (Complaints, RAPEX etc.); Method development work etc. ongoing.**		

Appendix 8:

Public Analyst:	Mr. Rory Mannion
Deputy Public Analyst:	Dr. Padraig Burke
Deputy Public Analyst:	Vacant (Since Nov 2009)
Quality Manager:	Dr. Helena McGrath
Executive Analytical Chemists:	Ms. Sharon Crowe
	Dr. Michelle Cuffe (On leave from 05/10/2015)
	Dr. Caroline Lardner
	Dr. Brenda Lennon
	Dr. Christopher Laffey
	Dr. Andrew Flanagan (On leave from 15/02/2016)
	Dr. Leonie Wallace
	Dr. Declan Costello
	Dr. Katie Coyle
	Dr. Gayle Kealy
	Dr. Georgina Smyth (From 01/02/2016)
	Dr. Edel Houton (From 15/02/2016)
Chief Technician:	Vacant (Since Aug 2007)
Senior Laboratory Technicians:	Mr. Martin Patten (Retired on 31/12/2016)
	Ms. Mary Finan (Retired on 04/01/2015)
	Ms. Patricia Thornton
	Ms. Eithne Clasby (Retired on 06/02/2015)
	Ms. Elaine Goldrick
	Ms. Suzanne Davoren
	Ms. Noelle Brennan (From Oct 2015)
	Ms. Nora Madden (From Oct 2015)
Laboratory Technicians:	Ms. Cecily Gilmore
	Mr. Martin Gilligan (Resigned on 15/01/2016)
	Ms. Noelle Brennan (Up to Oct 2015)
	Mr. Tom Fogarty
	Mr. Eric Costello
	Ms. Caitriona Greaney
	Ms. Sylvia O'Flynn
	Ms. Nora Madden (Up to Oct 2015)
	Ms. Amanda McCarron
	Ms. Deirdre Muldoon
	Ms. Aileen Maughan
	Mr. Tommy Heneghan
	Ms. Mary Rabbitte
	Ms. Caroline Lupton
	Ms. Louise Mannion
	Ms. Hilary Hardy (On career break from 01/01/2014)
Asst. Staff Officer:	Vacant (Since 2010)
Clerical Officers:	Ms. Eileen Mannion
	Ms Aine Mahoney
	Ms Johanna McHugh
	Vacant position (Since Oct 2007)
Housekeeper:	Ms. Theola Busch

The period 2015 to 2016 saw the departure of four staff members, three due to retirement and one due to resignation.

Congratulations are due to Ms. Noelle Brennan and Ms. Nora Madden both of whom were promoted to a Senior Laboratory Technician position in October 2015.

I would also like to welcome two staff members, Dr. Georgina Smyth, and Dr. Edel Houton who joined the laboratory in 2016 in a temporary capacity to replace Dr. Michelle Cuffe and Dr. Andrew Flanagan, both of whom availed of leave.

Eithne Clasby

Eithne joined the laboratory in 1978 having worked previously in the "Ferenka" plant in Limerick. She spent the greater part of her career in the Environmental section of the laboratory where she loved her work and took great pride in everything she did. The care and attention to detail, and the responsibility and ownership she took in adhering to the highest standards marked out her work throughout her career. Eithne was always a very active sports-person. She played soccer in her early years at the laboratory and more recently had taken up golf and rowing. Eithne never liked to leave things half-finished or incomplete. She would bring that steely determination and resolve to bear on challenging issues to ensure the job was done. It is that steely determination and resolve which Eithne had to summon towards the end of her career when she had to retire early, due to serious illness, after 37 years of service from a job she loved. Sadly she did not get to avail of the long retirement she deserved, as she passed away in October 2015, a mere eight months after her retirement. During that time she displayed remarkable resilience and good humour and was an inspiration to us all in the manner in which she bore her illness.

Martin Patten

Martin retired on the 31st December 2016, after forty years of service in the Public Analyst's Laboratory. He spent the greater part of his career in the water section of the laboratory and was an integral part in its development over the years. Throughout his career Martin was recognised for the skill and diligence he always applied to his work. He not only embraced all the developments in technology introduced to the laboratory, but mastered them also. Martin had an acute sense of justice and fair play which he would display in an unselfishness manner and was always mindful of the well-being of others. His wisdom was often sought after, and his interesting anecdotes and clear recollections of past events were both entertaining and informative. These traits made Martin a popular and respected figure in the laboratory.

Mary Finan

Mary retired on the 4th January 2015 after thirty eight years of service in this laboratory. This completed a working life of forty years as Mary had spent two years in the civil service prior to beginning her long career in the Public Analyst's Laboratory. For most of this time she had to commute from Ballinlough in Co. Roscommon on a daily basis, a round trip of almost ninety miles, winter and summer. Mary remained undaunted by this gruelling routine and found time to exercise her passion of playing Bridge, and maintained her interest in both local and national politics. Mary worked in all areas of the laboratory, spending many years in the water section during a period of significant change and modernisation, and finishing her career in the Food section. Mary was always recognised as a straight talker and rock of sense, and someone with sound judgement which was an asset to the laboratory service. More importantly perhaps, these and other qualities have resulted in her being a very good, very supportive, and very valued friend and confidant to many of her colleagues and I have no doubt many others besides

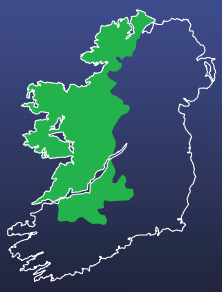
Martin Gilligan

Martin resigned on the 15th January 2015 to take up a position with the Forensic Laboratory in Dublin having joined the staff of this laboratory in January 1994. Most of his career was spent in the Food section of this laboratory where he always took his work very seriously and applied himself with great dedication. Martin was a popular and gentlemanly character who had many interests outside the laboratory including stage performing. The thoroughness and dedication which Martin always applied to his work should serve him well in his new position in the Forensic Laboratory.

On behalf of all the staff, I would like to wish long and happy retirements to Mary and Martin, and a long and successful career to Martin Gilligan in his new appointment.

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

HSE WEST



Public Analyst's Laboratory
Seamus Quirke Road,
University College Hospital,
Galway, H91 Y952

Tel: 091-581122 Fax: 091-581212