The Director General

Maisons-Alfort, 10 May 2019

OPINION

of the French Agency for Food,

Environmental and Occupational Health & Safety

on the "optimisation of the official monitoring and control plans on the chemical contamination of food at all stages of the food chain (excluding water and animal feed)"

ANSES undertakes independent and pluralistic scientific expert assessments.

ANSES primarily ensures environmental, occupational and food safety as well as assessing the potential health risks they may entail.

It also contributes to the protection of the health and welfare of animals, the protection of plant health and the evaluation of the nutritional characteristics of food.

It provides the competent authorities with all necessary information concerning these risks as well as the requisite expertise and scientific and technical support for drafting legislative and statutory provisions and implementing risk management strategies (Article L.1313-1 of the French Public Health Code).

Its opinions are published on its website. This opinion is a translation of the original French version. In the event of any discrepancy or ambiguity the French language text dated 10 May 2019 shall prevail.

On 14 August 2015, ANSES received a formal request from the Directorate General for Food (DGAL), the Directorate General for Competition, Consumer Affairs and Fraud Control (DGCCRF) and the Directorate General for Health (DGS) to undertake the following expert appraisal: optimisation of the official monitoring and control plans on the chemical contamination of food at all stages of the food chain (excluding water and animal feed) (Request No 2015-SA-0187).

1. BACKGROUND AND PURPOSE OF THE REQUEST

The report of the Interministerial Committee for the modernisation of public administration (CIMAP) underlined the need to improve national health monitoring, with regard to acute risks associated with certain emerging pathogens as well as chronic risks associated with chemical contaminants. Moreover, a survey undertaken by the Research Centre for the Study and Monitoring of Living Conditions (CREDOC), as well as a study implemented by the European Food Safety Authority (EFSA), found that consumers' concerns primarily revolve around chemical risks, especially those related to plant protection products, drug residues (antibiotics, hormones) and environmental pollutants (dioxins, PCBs, trace metal elements). Furthermore, several EFSA Opinions have highlighted the health concerns associated with consumer exposure to certain chemical contaminants (acrylamide, perchlorate ions, nickel, deoxynivalenol, etc.).

In terms of product safety, in accordance with the European regulations, State services are responsible for undertaking controls, in particular within the framework of monitoring and control plans, to verify the compliance of the products placed on the market.

These monitoring plans are organised according to regulatory requirements and/or a usually sectoral risk assessment based on the principle of "risk-based" planning, as provided for in Regulation (EC) No 882/2004[1] on official controls. This "risk-based" planning involves taking into account the risks associated with raw foods on the one hand and with processing methods in food sector companies on the other hand.

The revision of Regulation (EC) No 882/2004[2] on official controls will lead to the repeal of a series of texts regulating the development and implementation of national monitoring plans, including Directive 96/23/EC[3] on measures for monitoring numerous substances and groups of residues in foods upstream in the food chain.

"Risk-based" planning has been reaffirmed in the new draft Regulation on official controls. This will provide Member States with more freedom in the choice and organisation of their controls.

Thus, changes to the official controls for chemical substances in foods should be considered in light of an integrated risk assessment at national level taking into account the wide variety of contaminants and food matrices contributing to consumer exposure.

The current challenge for the authorities is to optimise the relationship between the cost of monitoring and the related health benefits while maintaining a high level of consumer safety. This optimisation is essential within the current context of downsizing and reducing controls undertaken by inspection services.

As part of the action plan implemented following the release of the CIMAP report, the authorities in charge of managing food-related health risks are looking to study the various parameters of the monitoring and control plans for chemical contaminants likely to optimise the level of health and safety, with the use of the same resources by the control authorities.

ANSES was therefore asked to:

1.   Undertake a survey of food contamination levels by analyte/matrix pair (or by class of analytes/matrices if relevant) in the sectors concerned – excluding animal feed – and at the various stages of the food chain, taking into account the origin of the matrices (third country, EU, France), on the basis of public data (DGAL and DGCCRF monitoring plans, Total Diet Studies (TDSs), national and European health alerts, etc.); if possible, five-year contamination levels should be analysed and possible gaps or redundancies identified in light of the various objectives described above;

2.   Undertake a critical analysis of the current European regulatory framework for the monitoring of chemical contamination in food and of its ability to meet the objectives set out above; make suggestions for improvements that could be implemented at European level.

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[1] Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules
[2] Regulation (EU) 2017/625
[3] Council Directive 96/23/EC of 29 April 1996 on measures to monitor certain substances and residues thereof in live animals and animal products and repealing Directives 85/358/EEC and 86/469/EEC and Decisions 89/187/EEC and 91/664/EEC

Together with the DGAL, it was agreed to rephrase this request as follows:

- Analyse whether the European "recommendations" on the choice of matrix/substance pairs are in line with the protection of public health and the general objectives of the monitoring and control plans (MP/CPs);

- If necessary, specify a minimum frequency and a minimum number of analyses to be undertaken.

3. Make proposals to improve the official monitoring plans for chemical contaminants during primary production and in food, using the same resources, by listing the parameters likely to be optimised (e.g. choice of matrix/substance pairs depending on the sector, definition of sampling plans, minimum frequency of plans) and exploring connections and synergies with other monitoring tools (TDSs, operator self-controls, etc.).

2. ORGANISATION OF THE EXPERT APPRAISAL

The expert appraisal was carried out in accordance with French Standard NF X 50-110 "Quality in Expert Appraisals – General Requirements of Competence for Expert Appraisals (May 2003)".

It falls within the sphere of competence of the Expert Committee (CES) on "Assessment of physico-chemical risks in food" (ERCA).

ANSES entrusted the examination of this formal request to the Working Group on "MP/CPs". The methodological and scientific aspects of this group's work were regularly submitted to the CES.

The report produced by the Working Group takes account of the observations and additional information provided by the CES members.

The work was adopted by the CES ERCA at its meeting on 14 December 2018.

The expert appraisal was carried out in two phases:

1. Scientific and technical support (STS) for the provision of data from the MP/CPs. ANSES's Food Observatory Unit (UOA) was called on to provide access to the MP/CP database on chemical contamination in food for the 2010 to 2014 period.

2. The actual work of the Working Group (WG), which consisted in:

- Analysing, processing, exploiting and interpreting the MP/CP data: preparation of a summary for each substance/matrix pair;

- Interviewing supervisory ministries and National Reference Laboratories (NRLs);

- Identifying substances of concern and substances for which monitoring should be considered;

- Analysing the regulatory framework for each substance/matrix pair;

- Proposing a methodology for decision-making and the identification of relevant criteria;

- Issuing recommendations aiming to improve and optimise the MP/CPs.

ANSES analyses the links of interest declared by the experts prior to their appointment and throughout the work, in order to avoid potential conflicts of interest with regard to the matters dealt with as part of the expert appraisal.

The experts' declarations of interests are made public via the dpi.sante.gouv.fr website.

3. ANALYSIS AND CONCLUSIONS OF THE CES ERCA

3.1. Processing of the available monitoring and control (MP/CP) data

This work was based on datasets relating to the DGAL and DGCCRF MP/CPs for the 2010 to 2014 campaigns, not including animal feed or water intended for human consumption.

The data taken into account evolved to take into account updates made to ANSES's "Contamine[4]" database as well as new available data (for example, addition of data not included in the "SIGAL[5]" system).

The following classes of substances were selected:

- Inorganic contaminants

- Organic contaminants (excluding toxins)

- Mycotoxins

- Marine biotoxins (or phycotoxins)

- Plant toxins (or phytotoxins)

For pesticide residues, the responses to this request were processed as part of DGCCRF requests submitted to ANSES[6], to take account of the obligations in Regulation (EC) No 396/2005[7]. Therefore, these substances have not been included in this Opinion. Lastly, the CES decided to exclude veterinary medicinal products from the scope of this request, given the poor quality of the available data (see page 10, or page 48 of the report).

Limitations regarding the use of the data are addressed in Section 3.4.2.

3.2. Other sources of data used to identify substances of interest for which monitoring should be considered

3.2.1. Exploitation of the data of the Rapid Alert System for Food and Feed: RASFF

The Rapid Alert System for Food and Feed (RASFF)[8] is an alert system based on notifications from the 28 member countries of the EU, in addition to Iceland, Liechtenstein and Norway, as well as the European Commission and the European Food Safety Authority (EFSA). RASFF enables the European Commission and food and feed control authorities to rapidly and effectively exchange information when a health risk has been identified, in order to carry out

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[4] Information Centre on Food Contamination
[5] SIGAL is the information system (IS) that includes the data from the DGAL's MP/CPs, among other things
[6] Opinion of 2 April 2014: https://www.anses.fr/fr/system/files/AUT2013sa0138.pdf
[7] Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC
[8] https://webgate.ec.europa.eu/rasff-window/portal/

coordinated actions and inform the population that there are food-related health risks. Although it is not representative, RASFF was used to supplement the data provided by the MP/CPs.

The RASFF reports, primarily relying on the regulations, cannot be used to identify emerging substances that may be of concern but are not currently covered by MP/CPs.

However, it is possible to perform queries for categories of substances and/or categories of matrices based on the notification data available online on the RASFF portal.

Thus, this alert system was used to qualitatively supplement the MP/CP data and if necessary corroborate the recommendations issued by the WG. The following keywords were used to search for notifications: "industrial contaminants" (or another keyword depending on the contaminant in question), "Notification type: alert", "Risk decision: serious". It was performed for the "food" category over the period running from 01/01/2010 to 31/12/2014.

3.2.2. Guides to good hygiene practice: GGHPs

GGHPs (guides to good hygiene practice and application of HACCP[9] principles) are reference documents prepared by a professional sector for workers in that sector. Their objective is to help professionals manage food safety satisfactorily and comply with regulatory requirements by identifying and characterising the hazards associated with the various stages of food production and manufacturing, and by assessing the related risks. These hazards are selected based on an assessment of their severity and frequency of occurrence in each step of production and manufacturing. Chemical contaminants newly formed during technological processing and/or industrial or domestic preparation (acrylamide, aromatic amines, PAHs, etc.) are thus taken into account, as are additives, flavourings, processing aids, food contact materials (FCMs), residues from various maintenance, cleaning and disinfection processes, and chemical hazards associated with water. Trace metal elements (TMEs) are also taken into consideration.

The analysis of the short-list of significant and relevant hazards[10] did not enable any emerging substances or substance/matrix pairs to be identified.

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[9] Hazard Analysis and Critical Control Point
[10] https://www.anses.fr/fr/system/files/GBPH2013sa0169.pdf

3.2.3. List of the substances of concern identified by the Working Group

Certain substances or classes of substances, identified by the Working Group based on expert opinions, can be considered as being of concern and may be covered by monitoring or control plans. This list can be found in Annex 2.

3.3. Decision-making methodology developed by the Working Group

The available MP/CP data enabled the identification of 576 substance/matrix pairs for which the WG developed a methodology with a view to proposing optimisation recommendations.

### *3.3.1. Decision tree and definition of criteria*

In order to interpret the contamination levels taken from the MP/CP data for the 2010 to 2014 period, the experts defined several key questions and established several criteria enabling them to issue recommendations for the monitoring of each substance/matrix pair. They thus produced a decision tree for the choice of recommendations, to summarise the criteria enabling them to adopt an approach consistent with the profile of each substance/matrix pair (see Figure 1).

For each substance/matrix pair, the various criteria taken into account were as follows:

- Health concern: this criterion was established based on the conclusions of the Second Total Diet Study (TDS2), the infant Total Diet Study (iTDS), and EFSA and JECFA publications (exceeding of HBGVs, risk management actions to be taken to reduce contamination and exposure, etc.).

- Contribution to total exposure: this criterion was mainly established based on the TDSs (and sometimes on EFSA reports) and enabled a list of the 10 largest contributors to total exposure to be defined for each substance. In this work, a "major contributor"[11] was defined as a group of foods accounting for more than 1% of total exposure to the substance.

- The European regulations: this criterion was established according to the regulatory status of the substance/matrix pair in question at the beginning of the study (2014). Note that within the same food category, a substance can be regulated in one food matrix and not regulated in another.

- Data robustness: in the context of this request, data were considered as sufficiently robust when at least 20 analytical results were available per food category over a period of at least three consecutive years.

- Non-compliance: this criterion was established exclusively for regulated substance/matrix pairs for which percentages exceeding the maximum level (ML) were available. This criterion was interpreted as a whole based on the level of excess and the number of years in which the ML was found to be exceeded.

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[11] Considered as significant by the Working Group

Figure 1: Decision tree developed by the Working Group
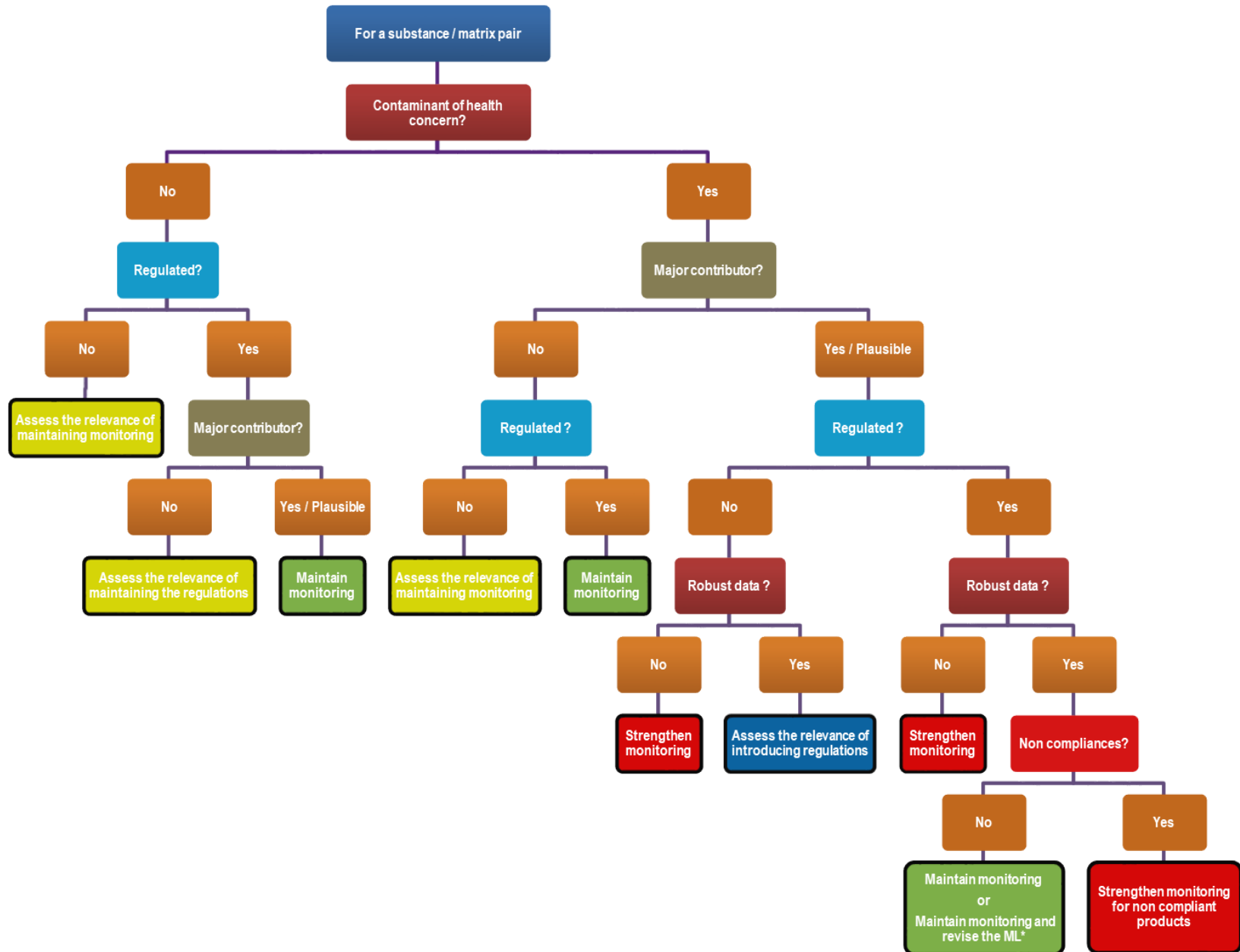
The reasoning underlying this decision tree was based mainly on two criteria defining the health importance of a food/hazard pair: the health concern associated with the hazard, and the food's contribution to exposure to this hazard. This approach therefore eliminated usual considerations relating to the notions of monitoring and control plans, whose definitions are used by authorities to structure their analytical actions.

As a reminder, these terms are distinguished as follows in the Multiannual National Plan for Official Controls (PNCOPA) (extracted from the 2016-2020 PNCOPA, page 25)[12]:

"In general, MP/CPs are plans aiming to verify food compliance and safety. They are often based on European regulations but can also reflect national concerns (if the regulations are not harmonised or not completely harmonised, as in the case of food contact materials). In reality, the term 'MP/CP' encompasses two types of plans with different objectives:

· monitoring plans aim to provide a 'snapshot' of the state of contamination in the food chain or a given production sector associated with a substance likely to pose a health risk. Monitoring is not targeted, and the results of these plans are generally representative of the territory. Monitoring plans are generally not meant to be repressive;

· control plans, on the other hand, more specifically target suspect products or the most at-risk companies in a given production sector. These plans are generally meant to be repressive.

Monitoring and control plans for MP/CP products are aimed at operators, whether they are processors, manufacturers or distributors. They focus on at-risk products and stages of the food chain, based in particular on the opinions and studies of ANSES and EFSA, enabling the main contributors to consumer exposure to a given hazard to be targeted. The planning of MP/CPs therefore relies on a risk analysis.

MP/CPs are managed by the DGCCRF and DGAL in accordance with the division of powers defined between the two control authorities. The two structures meet once a year to discuss this topic. It should be noted that there are other MP/CPs that also deal with animal feed".

The methodology proposed in this Opinion will nonetheless enable authorities to structure their control/monitoring strategies based on these definitions as needed, in particular according to the status of the hazard and whether it is regulated or not (which would tend to coincide with an *a priori* monitoring phase, a data collection phase with a view to assessing risks, or a pre-regulatory phase for the collection of contamination data) and according to the purpose of the analysis (control phase if searching for offences with targeting, or else random sampling for monitoring). Therefore, in this report, the words "monitoring" and "control" are used interchangeably.

3.3.2. Definition of the various possible recommendations

The Working Group identified several recommendations based on the criteria used in the decision tree.

- **"Strengthen monitoring for non-compliant products"**: involves all regulated pairs for which the maximum levels of a substance considered as being of health concern are regularly exceeded in a matrix deemed a large contributor[13]. This recommendation means it is necessary to increase the number of analyses for the relevant sub-categories of foods.

- **"Strengthen monitoring"**: involves regulated and non-regulated pairs, where the substance is considered as being of health concern and the matrix is a large contributor, and for which the number of samples and/or the sampling regularity are deemed

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[12] https://agriculture.gouv.fr/telecharger/83813?token=5dcc5fedcaf4622c4a932b5647a6f01c

[13] As defined in Section 3.3.1

inadequate. This recommendation means it is necessary to increase the number of analyses for the pairs in question (≥ 10 per year).

- **"Maintain monitoring"**: involves regulated pairs, where the substance is of health concern or the matrix is a large contributor, and for which the level of monitoring is deemed adequate. The current level of monitoring should be maintained.

- **"Maintain monitoring and revise the ML"**: involves regulated pairs, where the substance is of health concern and the matrix is a large contributor, for which the lack of non-compliances may be related to the ML being too high. In this case, the ML should be lowered.

- **"Assess the relevance[14] of maintaining monitoring"**: involves

  o Non-regulated pairs where the substance is considered as being of health concern but the matrix is not a large contributor to total exposure.

  o Non-regulated pairs where the substance is considered as not being of health concern.

- **"Assess the relevance of introducing regulations"**: involves non-regulated pairs where the substance is of health concern and the matrix is a large contributor.

- **"Assess the relevance of maintaining the regulations"**: involves regulated pairs where the substance is not of health concern and the matrix is not a contributor.

The conclusions proposed by the decision tree were systematically reviewed by the WG's experts, who sometimes changed these conclusions for specific reasons. In this case, the reason for the change to the conclusion from the tree is included in the sheets in Annex 2 of the report.

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[14] "Assess the relevance" refers to the need to undertake a specific expert appraisal for the corresponding substance/matrix pairs

3.4. Result of the expert appraisal
3.4.1. MP/CP results

a. Substances reviewed in the context of the request

As requested by the supervisory ministries and based on data availability in the MP/CPs, the following substances were reviewed.

Table 1: List of substances reviewed in the context of this request

Substance group	Substance class	Substance
Inorganic	TMEs	Aluminium
		Arsenic
		Cadmium
		Tin
		Lead
		Mercury
		Nickel
		Nitrate
		Perchlorate ions
Mycotoxins		Aflatoxins
		Fumonisins
		Trichothecenes (T-2/HT-2 and deoxynivalenol)
		Ochratoxin A
		Patulin
		Zearalenone
Organic	PCDD/Fs	Dioxins
		Furans
	PCBs	DL-PCBs
		NDL-PCBs
	Newly-formed compounds	3-MCPD
		Acrylamide
		PAHs
		BaP
		Ethyl carbamate
		Furan
		Perfluorinated compounds
		Brominated flame retardants
Marine biotoxins		Azaspiracids
		Domoic acid
		Yessotoxins
		Okadaic acid-Dinophysistoxins and Pectenotoxins

Substance group	Substance class	Substance
Phytotoxins		Saxitoxins
		Cyclic imines
	Opium alkaloids	Codeine and morphine
		Thebaine
	Tropane alkaloids	Atropine and scopolamine
	Pyrrolizidine alkaloids	Echimidine
		Europine
		Heliotrine
		Lasiocarpine
		Lycopsamine
		Monocrotaline
		Retrorsine
		Senecionine
		Seneciphylline
		Senkirkine
		Trichodesmine
		Indicine
		Intermedine

For each of these substances or classes of substances, a sheet (Annex 2 of the report) was prepared, including a hazard characterisation, a summary of the corresponding regulations, analytical methods, a review of the MP/CP data for each relevant food category or matrix, and the WG's recommendations by food category. Graphs of contamination levels by food category and non-compliance curves (for regulated pairs only) are given in Annex 3 of the report.

b. Veterinary drug residues

Veterinary medicinal products fall within the scope of the request but were not analysed for the reasons stated during the work undertaken between 2013 and 2015 as part of Internal Request No 2014-SA-0062 on the assessment of consumer exposure to veterinary drug residues.

In fact, the steering committee for this Internal Request concluded that the expert appraisal could not be continued. The quality of the data collected by the laboratories will need to be harmonised before these monitoring data can be used to estimate exposure to veterinary drug residues.

The data from the 2017 MP/CPs are now available in the form of a harmonised database and are currently being analysed at ANSES (DER/UERALIM Unit and UME) with the aim of estimating the exposure of the French population. This work will be presented in a report.

c. Pesticide residues

In its Opinion of 2 April 2014[15], ANSES assessed levels of dietary exposure to pesticide residues in the general French population over the age of three years, based on the INCA 2 food consumption data and the food contamination levels observed in 2011.

It proposed a classification of pesticide residues based on the risk characterisation results and the assessment of the related uncertainties: a level of priority in terms of risk assessment and/or management was assigned to each substance. Furthermore, the Opinion sets out levels of contamination in each food as well as levels of chronic exposure to each pesticide residue: quantification frequencies, mean contamination values, and chronic and acute risks and exposure levels. It is thus possible to identify the various pesticides that simultaneously contribute to exposure for the same food or group of foods, with a view to improving knowledge of combined exposure. Furthermore, Regulation (EU) No 37/2010, in particular the MRLs for around 20 veterinary antiparasitics, was taken into account to enable an initial assessment of theoretical maximum exposure to these pesticides.

3.4.2. Limitations and uncertainties

All of the results and conclusions of this work relied on the use of different data sources that inevitably had some methodological limitations, generating uncertainties possibly limiting the scope of certain conclusions.

For example, health concern was defined based on information taken mainly from the TDS2 and iTDS studies and sometimes from EFSA or JECFA publications. However, certain substances were only studied in the iTDS (for example), which meant that the degree of health concern could only be assessed based on data obtained in young children, who are not necessarily representative of the general French population. Moreover, the TDS2 was a study dealing with the general population, and a substance/matrix pair that is not of concern for this category may in fact be of concern for a specific sub-population. In this case, a conclusion that is valid for the general population may not apply for this sub-category. Another limitation associated with these studies stems from their relatively early dates of implementation (2006-2010). The INCA 2 study used for the calculation of exposure is also around 10 years old. It is thus entirely possible that some conclusions dating from this period are no longer relevant today due to changes in eating habits. One result may be that substance/matrix pairs deemed to be of concern based on data generated on these dates are no longer of concern, or vice versa. The use of EFSA or JECFA reports does not itself bring about systematic improvements, either because they focus on broader populations or because they are directly based (for France) on data from the TDS and INCA studies.

Furthermore, for several non-regulated substance/matrix pairs, the analyses undertaken as part of the MP/CPs were only carried out during a single campaign with a small sample size; in this case, the issue of the choice of matrices can be raised. In such conditions, it is not possible to conclude as to the representativeness of the result, its intrinsic value, or a possible trend over time. Therefore, the conclusion is not very robust.

The fit between the pairs assessed as part of the MP/CPs and earlier data (TDSs) is sometimes unclear, especially when it has not been possible to access the most detailed level of the food

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[15] https://www.anses.fr/fr/system/files/AUT2013sa0138.pdf

classification in the databases. There may have been biases related to the level of precision of the food category, during the definition of contributors in particular.

In light of results from control plans and possibly targeted plans, a bias leading to the potential overestimation of contamination values should not be neglected. Moreover, sub-sampling with the same pair may have the opposite effect and cause contamination to be underestimated.

A number of pairs have been considered as irrelevant. It is likely that some of them appear as such because the analyses were undertaken using multi-residue methods. These are therefore provided for a group of substances of which one or more are truly of interest for a given matrix, but not necessarily for all of the analysed substances. It was thus possible to go even further by simultaneously considering several substances (e.g. TMEs). This potentially increased the number of pairs appearing under the conclusion "assess the relevance of maintaining".

The "health concern" question, which is the root node of the decision tree, was answered for each substance individually. Therefore, the issue of mixtures was not considered in this work.

Lastly, the identification of substances or classes of substances that are considered as potentially being of concern, but are not included in monitoring or control plans and could be sources of emerging risks, is a complex task. Furthermore, in light of the thousands of possible substance/matrix pairs and ongoing technological innovations, the "substances of concern for which monitoring should be considered" part of the report entails prospective work that remains incomplete by nature and should be reviewed and supplemented on a regular basis.

While these limitations may seem significant, they do not call into question the conclusions of this work. They simply mean that certain conclusions, relying on incomplete information, should be considered with caution.

3.4.3. Recommendations of the Working Group

Based on the decision tree (see Section 3.3.1) and the analysis of the MP/CP data for the 2010-2014 period, recommendations have been proposed for each substance/matrix pair. They are presented by food category – hierarchical level H1[16] – in the form of tables and sometimes text in the sheets in Annex 2 of the report for finer sub-categories of foods.

In total, 576 recommendations have been issued by the Working Group. Detailed tables are presented in Annex 4 of the report, by type of recommendation (Annex 4a) or by substance (Annex 4b).

In order to summarise all of the recommendations as clearly as possible, the WG decided to group them into four main action categories:

➡ **Maintain**: This category encompasses the following recommendations: "Maintain monitoring" and "Maintain monitoring and revise the ML".
It implies that the monitoring system is effective and relevant and that the efforts already made should be continued. The WG considers that discontinuing the monitoring of the pairs in this category would reduce the system's effectiveness and potentially compromise health and safety.

➡ **Strengthen**: This category encompasses the following recommendations: "Strengthen monitoring" and "Strengthen monitoring for non-compliant products".

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[16] Least detailed hierarchical level of EFSA's FoodEx food classification system

Gaps and weaknesses were identified in the monitoring system for the pairs included in this category. The system therefore needs to be strengthened.

➥ **Create?**: This category is associated with the "Assess the relevance of introducing regulations" recommendation. Reflection is necessary in order to consider regulating the pairs falling in this category. Data should systematically be obtained on an annual basis, since these pairs may pose a potential health risk.

➥ **Reduce?**: This category encompasses the following recommendations: "Assess the relevance of maintaining the regulations" and "Assess the relevance of maintaining monitoring". It requires reflection on whether to maintain the regulations or monitoring, in order to relax the system for the pairs in question. This reflection should include all factors that may influence the decision-making process (other recommendations, recent data showing the emergence of contamination involving one of the contaminants in question, etc.).

a. Distribution of the recommendations by regulatory status

According to the distribution of these categories of recommendations between regulated and non-regulated substance/matrix pairs (Figure 2), more than half of them involve pairs for which a reflection on reducing the system (monitoring in particular) should be undertaken, and almost a quarter of them involve pairs for which the monitoring system should be strengthened.

As shown by the two graphs in Figure 3, the distribution of the recommendations differs depending on the regulatory status of the examined substance/matrix pairs.

Regarding regulated pairs, the recommendations show that the current monitoring system is relevant and well suited to regulatory and health issues in 74.3%, i.e. almost three quarters, of the situations examined. This system should be strengthened in 16.8% of cases, in particular for products identified as non-compliant in terms of their regulatory levels (13.3%). The relevance of maintaining the regulations should be reconsidered in 8.8% of cases.

Regarding non-regulated pairs, it appears necessary to consider relaxing the monitoring system for two thirds of them. On the other hand, efforts should be focused on the 26.1% of

the pairs that are not regulated but of health concern, and for which monitoring therefore needs to be strengthened.
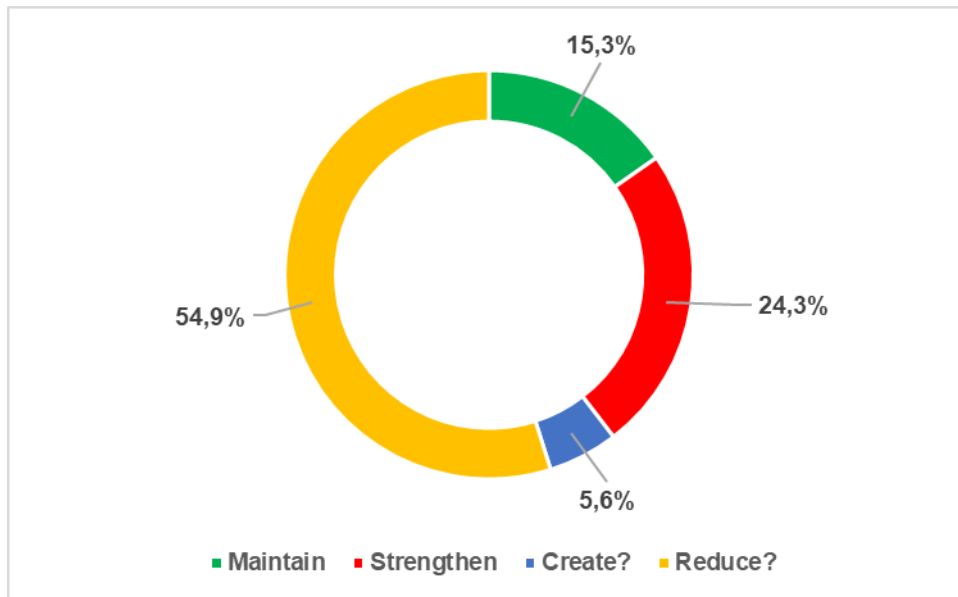

Figure 2: Distribution of the recommendations for the 576 substance/matrix pairs reviewed as part of this request
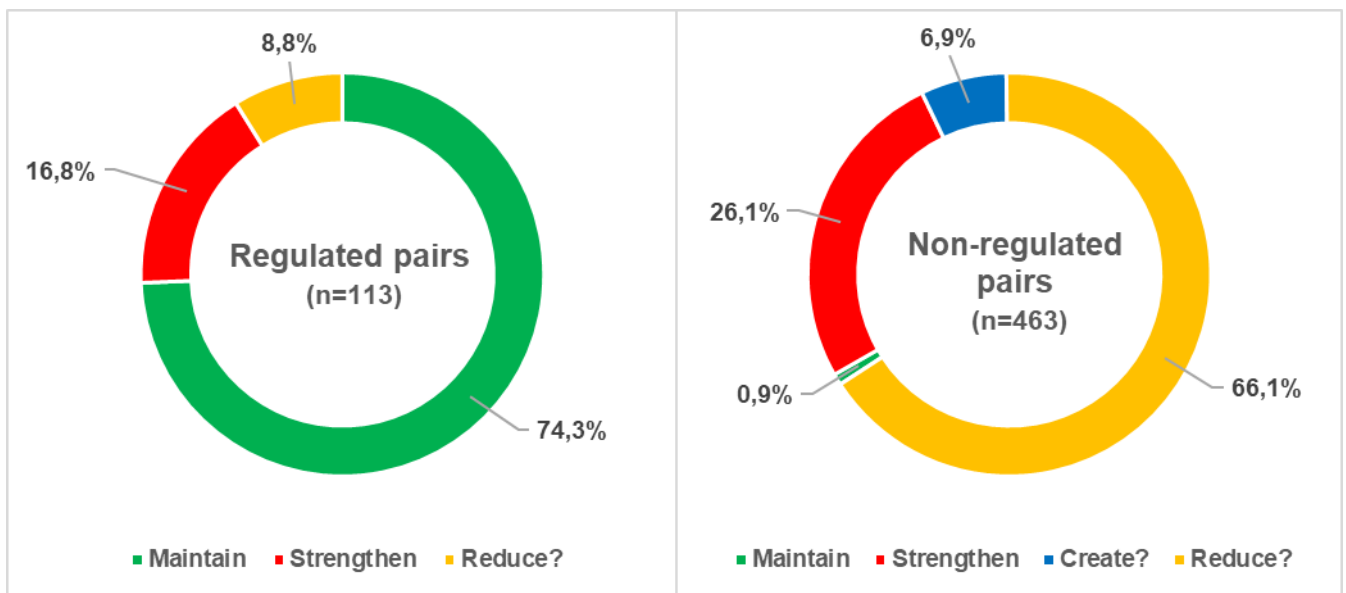

Figure 3: Distribution of the recommendations for regulated and non-regulated pairs separately

b. Distribution of the recommendations by substance class

Observing these same distributions by substance class can assist in the adjustment of annual plans. Indeed, since these plans are mainly organised by class of contaminants, it may be appropriate to determine, for the food matrix or matrices in question, those that require special attention and conversely, those for which monitoring should be relaxed.

For regulated substances, with the exception of newly-formed compounds, Figure 4 shows that the system enables a large share of chemical contamination in food to be effectively monitored. Nevertheless, the monitoring system should be strengthened for certain TMEs (cadmium, total mercury and lead), nitrate, mycotoxins (aflatoxins, deoxynivalenol and T-2-HT-2), certain newly-formed compounds (acrylamide), NDL-PCBs, dioxins and furans and perchlorate ions.

The current regulations on the following substances in regulated matrices should be reviewed: PAHs (benzo(a)pyrene (BaP) and sum of the four PAHs[17]), mycotoxins (fumonisins and zearalenone) and TMEs (inorganic tin).

Details regarding the food matrices in question can be found in the sheets dedicated to these substances and in the tables of recommendations in Annex 4 of the report.

Regarding non-regulated substances, the monitoring system should be reviewed for most of them with a view to relaxing it. The only substances for which the maintenance of monitoring is recommended are as follows: 13-desmethyl SPX-C for the "fish and seafood products" category, ethyl carbamate in "alcoholic beverages", and two mycotoxins (deoxynivalenol and zearalenone) in "food for infants and young children" (corresponding to the 0.9% in Figure 3).

Reflection and efforts should focus:

- firstly, on the following substances: opium alkaloids, certain TMEs such as aluminium, arsenic, cadmium and lead, nitrate, mycotoxins such as aflatoxin B1 and OTA, PCBs-PCDD/Fs and perfluorinated compounds PFOS and PFOA – when the introduction of regulations is recommended for these substances in the matrices in question.
- secondly, on phytotoxins (pyrrolizidine alkaloids), several TMEs, nitrate, certain BFRs and, to a lesser extent, mycotoxins, newly-formed compounds and PCBs-PCDD/Fs – when the strengthening of the monitoring system is recommended for these substances in the studied matrices.

Details regarding the food matrices in question can be found in the sheets dedicated to these substances and in the tables of recommendations given in Annex 4 of the report.

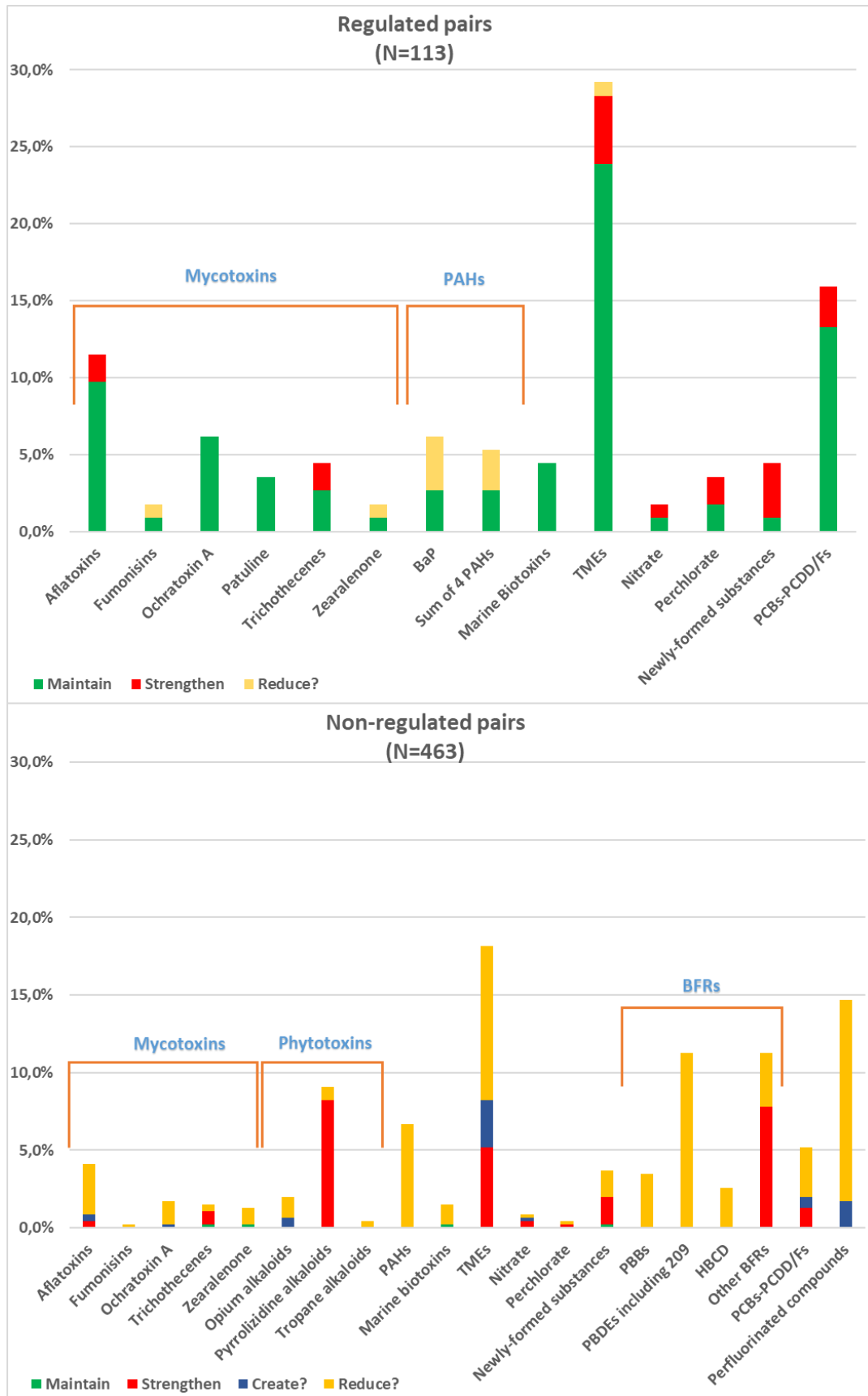[17] Benzo(a)pyrene + benzo(a)anthracene + benzo(a)fluoranthene + chrysene

Figure 4 : Distribution of the recommendations by substance class, for regulated and non-regulated pairs separately (%)

c. Distribution of the recommendations by food category

The following graphs (Figure 5) describe the distribution of the recommendations by food category and regulatory status. Each bar represents the percentage, by food category, of each recommendation out of the total recommendations issued for regulated and non-regulated pairs, considered separately. This provides a comprehensive and synthetic view of potential actions to be taken for food categories requiring them.

For example, for the regulated "eggs and egg products" category, all of the recommendations (2.7% of the total recommendations) correspond to the maintenance of monitoring and thus demonstrate the current system's effectiveness.

However, for the regulated "pulses, nuts and oilseeds" category, 60% of the recommendations (2.7% of the total recommendations) correspond to the maintenance of monitoring and 40% (1.8% of the total recommendations) to the strengthening of the monitoring system.
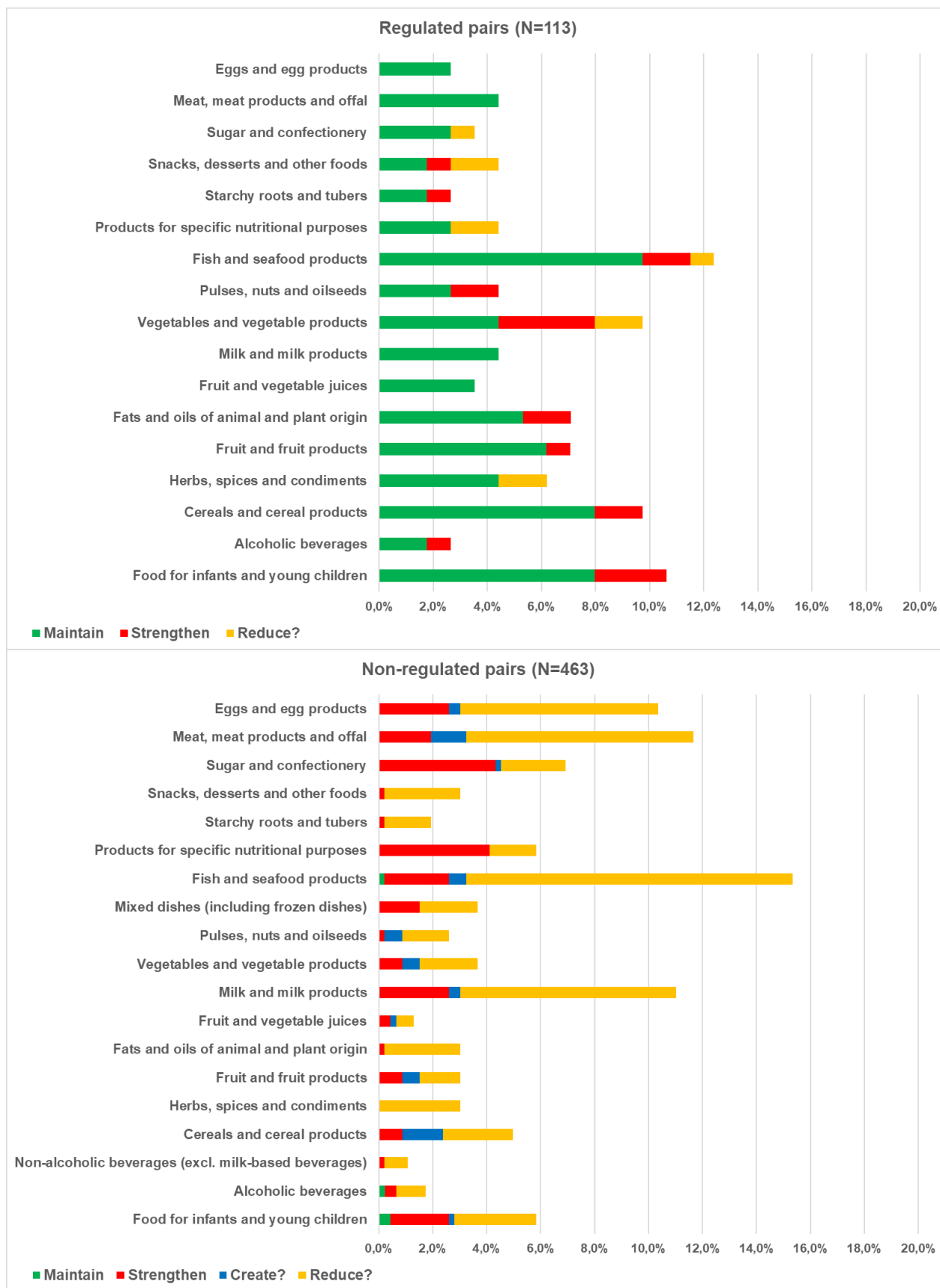
Figure 5: Distribution of the recommendations by food category, for regulated and non-regulated pairs separately (%)

d. Combined recommendations by substance class and food category

The following two figures provide greater detail by combining the two types of information, i.e. the distribution of the recommendations arranged in columns (food categories) and rows (substance classes), for all regulated and non-regulated pairs considered separately. This two-way presentation provides a direct synthetic view of the potential actions to be taken for each food category/substance class pair.

For **regulated pairs** (Figure 6), the majority of the recommendations are in favour of maintaining the current monitoring system.

However, it is recommended to strengthen the monitoring system for the following pairs:

- Certain TMEs (lead) in "alcoholic beverages",
- Certain mycotoxins (aflatoxins) in "pulses, nuts and oilseeds",
- Certain newly-formed compounds (acrylamide) in the "snacks, desserts and other foods", "starchy roots and tubers", "cereals and cereal products" and "food for infants and young children" categories,
- Nitrate in "vegetables and vegetable products",
- Perchlorate in "vegetables and vegetable products" and "fruit and fruit products".

The system should also be strengthened for some of the following pairs:

- Certain TMEs (cadmium, total mercury, lead) in "fish and seafood products" and "vegetables and vegetable products",
- Certain mycotoxins (trichothecenes) in "cereals and cereal products" and "food for infants and young children",
- PCBs-PCDD/Fs in "fats of animal and plant origin" and "food for infants and young children".

It is recommended to conduct a reflection on whether to relax the system:

- For inorganic tin in "fish and seafood products",
- For PAHs in "sugar and confectionery", "products for specific nutritional purposes", "vegetables and vegetable products" and "herbs and condiments",
- For certain mycotoxins (fumonisins, zearalenone) in "snacks, desserts and other foods".

As for **non-regulated pairs** (Figure 7), the result is completely different, with a majority of substance class/food category pairs for which a reflection should be considered with regard to the relaxation of the monitoring system.

For a large number of substance/matrix pairs, since the data are not sufficiently robust, the monitoring system should be strengthened by increasing the number of analyses.

Possible regulation should be considered for the following non-regulated pairs:

- DL-PCBs-PCDD/Fs in "meat and meat products",
- Phytotoxins in "pulses, nuts and oilseeds",
- Certain TMEs in "meat and meat products", "sugar and confectionery", "fish and seafood products", "vegetables and vegetable products", "fruit and vegetable

juices", "fruit and fruit products", "cereals and cereal products" and "food for infants and young children",

- Mycotoxins in "cereals and cereal products",
- Certain perfluorinated compounds in "meat and meat products", "fish and seafood products", "eggs and egg products" and "milk and milk products".

Since this is a recommendation with a high management impact, details for the pairs in question are given in the "Recommendations and conclusions of the CES" section below.

Figure 6: Combined recommendations by regulated substance class and food category
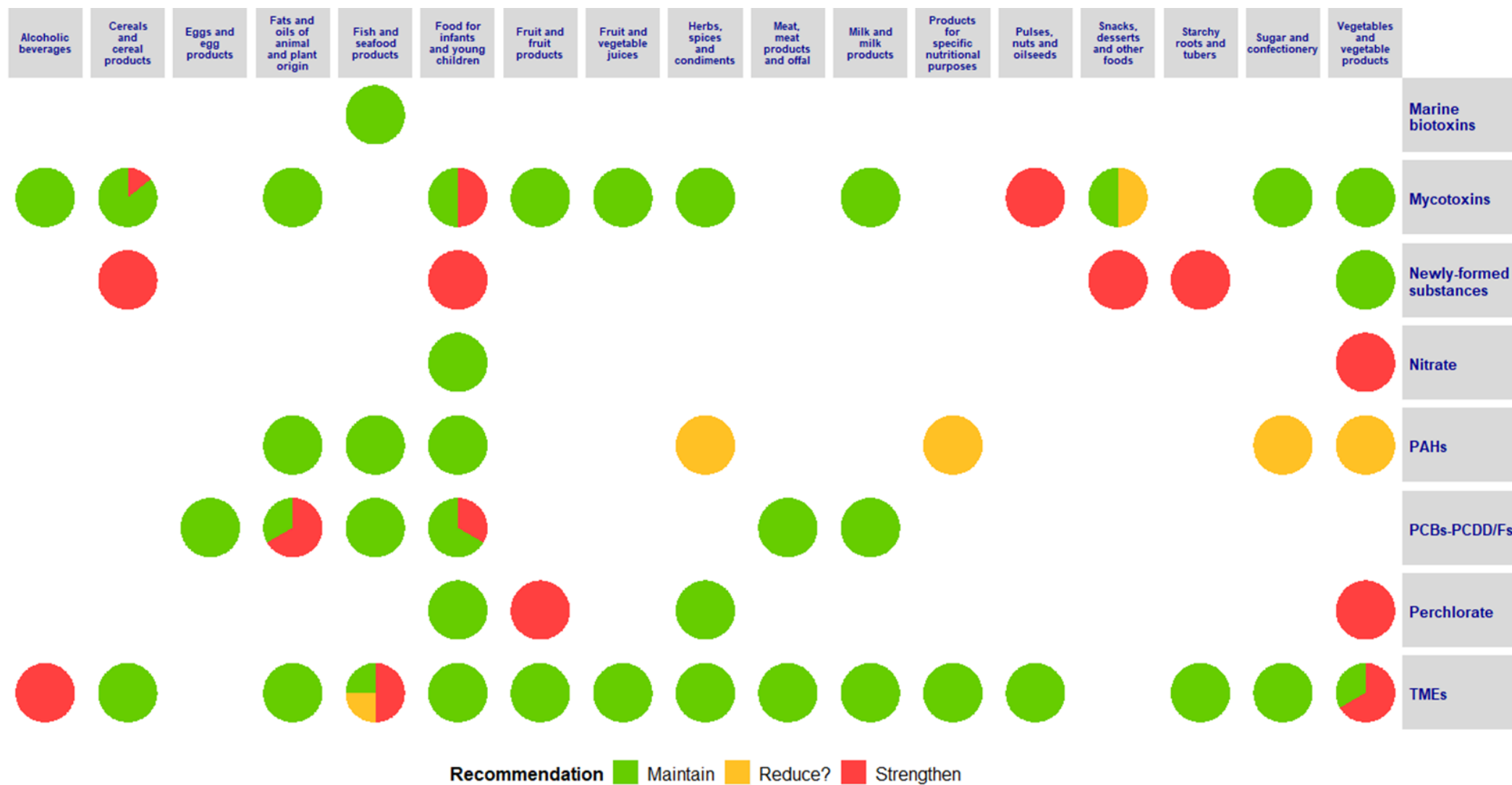
Figure 7: Combined recommendations by non-regulated substance class and food category

Recommendation: ■ Create? ■ Maintain ■ Reduce? ■ Strengthen

3.5. Recommendations and conclusions of the CES

This formal request was issued in a context of efforts to modernise the official monitoring and control plans. The Working Group's recommendations for the management of the current regulatory framework and monitoring system are based on a health approach.

The monitoring system for chemical contamination in food is very suitable for almost all of the regulated substance/matrix pairs. Therefore, it can serve as a contamination database to estimate, using a specific methodology, the French population's exposure to chemical contaminants and changes in this exposure over time. It could be worthwhile to determine the relevance of using these estimates between two TDSs, which would also provide a basis for a reflection on the organisation of future TDSs and on adjusting the list of relevant substances to be included in them.

- ❖ The CES recommends assessing the relevance of introducing regulations for 32 non-regulated substance/matrix pairs:
  - Three pairs involve opium alkaloids (codeine, morphine and thebaine) in the "pulses, nuts and oilseeds" category and specifically in poppy seeds.
  - Fourteen pairs involve several TMEs, including:
    - o Aluminium in "cereals and cereal products" and specifically in pasta.
    - o Total arsenic in the "food for infants and young children", "cereals and cereal products", "fruit and fruit products", "fruit and vegetable juices" and "vegetables and vegetable products (including mushrooms)" categories.
    - o Cadmium in the "cereals and cereal products" (flour and semolina, flaked cereals and fine bakery products), "fruit and fruit products" (olives, dried fruits, canned fruits and fruit compotes) and "sugar and confectionery" (chocolate-based products, sweets, molasses and honey) categories.
    - o Lead in the following categories: "cereals and cereal products" (flour and semolina, flaked cereals and fine bakery products), "fruit and fruit products" (olives, dried fruits, canned fruits and fruit compotes), "vegetables and vegetable products (including mushrooms)" based on data on coffee, cocoa and seaweed, "meat and meat products (including edible offal)", in particular game meat, and "fish and seafood products", with a focus on molluscs.
  - Three pairs involve aflatoxin B1, OTA and the sum of aflatoxins in "cereals and cereal products" such as pasta, breakfast cereals and bakery products including breads and rolls.
  - One pair involves nitrate in "vegetables and vegetable products (including mushrooms)".
  - Three pairs involve dioxins, PCBs and furans in the "meat, meat products and offal" category, and more specifically in rabbit meat, game meat (from birds and animals) and offal (kidneys, liver).
  - Lastly, eight pairs involve perfluorinated compounds, especially PFOS and PFOA, in "milk and milk products", "eggs and egg products", "fish and seafood products" and "meat, meat products and offal".

These recommendations were established based on the regulations in force at the time of this assessment and should be reviewed in the event that they are updated.

- ❖ The CES recommends assessing the relevance of maintaining the regulations for 10 regulated substance/matrix pairs:
  - Three pairs involve BaP and three involve the sum of the four PAHs in the "herbs, spices and condiments", "vegetables and vegetable products (including mushrooms)" and "products for specific nutritional purposes" categories. These three categories were considered as small contributors to exposure to these two substance classes, unlike the "food for infants and young children", "fats and oils of animal and plant origin" and

"fish and seafood products" categories, for which the maintenance of monitoring is recommended.

- One pair involves BaP in the "sugar and confectionery" category, considered as a small contributor.
- Two pairs correspond to mycotoxins (fumonisins and zearalenone), both in the "snacks, desserts and other foods" category, due to the small contribution to exposure.
- One pair corresponds to inorganic tin in the "fish and seafood products" category.

❖ The reflection on the assessment of the relevance of maintaining the regulations or monitoring and, in general, on relaxing the system for certain pairs, should take into account several factors:

- Updating of knowledge targeting the assessment of food-related risks: This may involve the acquisition of new contamination data (from the TDSs or other sources) or toxicological and/or epidemiological data, the revision of HBGVs[18], etc. Specifically regarding perfluorinated compounds, the conclusions of this work should be updated based on those of the EFSA report expected to be published in 2019, so that combined effects are taken into account[19].
- Emergence of new food consumption behaviour: Indeed, new consumption trends could modify the relative contributions of certain matrices, which would thus need to be monitored more closely. For example, the INCA 3 survey (2017)[20] showed that new "gluten-free" products were starting to be consumed, potentially leading to an increase in the consumption of products containing cereals other than wheat.
- Nutritional guidelines: The guidelines of the health authorities[21] should be taken into account, since they promote the consumption of foods in certain categories (fruit, vegetables, dairy products, whole-grain cereals, dried vegetables, nuts, fish, etc.) for which monitoring should be strengthened as needed.
- Populations not considered in this work: This work, and specifically the decision tree used as the basis for the recommendations, mainly relied on the assessments resulting from the TDSs. These studies aim to estimate the exposure of the general and child populations in metropolitan France (excluding Corsica), but they are not necessarily representative of populations with specific diets, such as vegetarians, or with diets related to geographical or cultural habits, etc. Specific studies should therefore be undertaken to cover all diets and thus all affected populations.

❖ Regarding the substances for which monitoring is recommended (Annex 2), the Working Group identified a number of substances (while being aware that this list is probably far from being exhaustive) that are not yet monitored or for which there is (or may be) an emerging risk. Data on food contamination with these substances should therefore be generated, in order to enable exposure levels to be established for the general population and allow management measures to be taken if necessary. If the resources currently available do not enable all of

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[18] Health-Based Guidance Value

[19] EFSA, 2018. Risk to human health related to the presence of perfluorooctane sulfonic acid and perfluorooctanoic acid in food. EFSA Journal 2018;16(12):5194

[20] ANSES, 2017. Third Individual and National Survey on Food Consumption (INCA 3). Opinion and report: https://www.anses.fr/fr/system/files/NUT2014SA0234Ra.pdf

[21] French Public Health Agency, January 2019. Recommandations relatives à l'alimentation, à l'activité physique et à la sédentarité pour les adultes. http://invs.santepubliquefrance.fr/Publications-et-outils/Rapports-et-syntheses/Maladies-chroniques-et-traumatismes/2019/Recommandations-relatives-a-l-alimentation-a-l-activite-physique-et-a-la-sedentarite-pour-les-adultes

these substances to be monitored annually in the MP/CPs, one option may be to alternate the plans from one year to the next by group of substances, which would allow robust contamination data to be generated for the matrices of interest and enable a conclusion to be drawn as to whether or not monitoring should systematically be maintained. As such, the Working Group considers that it is necessary to create a permanent structure in charge of organising and updating the monitoring of these substances.

❖ Changes in contamination due to climate change should be closely monitored. This is particularly true with regard to mycotoxins in general, regardless of changes in detection measured by monitoring plans. Indeed, the presence of fungi is favoured by rising temperatures, and various studies (experimental and based on modelling) have shown increases in their presence over time and therefore in likely contamination with mycotoxins. The two main mycotoxins generally considered in Europe are DON and aflatoxins (Van des Fels-Klerx et al., 2016; Battilani, 2018; Moretti et al., 2018)[22]. A study on changes in RASFF mycotoxin notifications showed that they have been increasing over the last few years. This issue also encompasses phycotoxins.

❖ For numerous matrix/substance pairs, sampling in the context of monitoring plans does not enable robust conclusions to be drawn with regard to maximum levels being significantly exceeded or in terms of any changes over time. In fact, when there are too few samples, it cannot be ruled out that they may not be representative of actual contamination levels. The possibility of misinterpretations is then very high, and the result (whether it is a single value, an average value or a spread) may be due to chance more than to any actual contamination. The WG considers that, to obtain robust information, there should be at least 30 or so samples per food category. One solution would be to increase the minimum number of samples to 10 per year for a substance/matrix pair. In this way, more accurate analyses of trends could be undertaken by calculating a three-year moving average. The value of 10 can also be considered as the minimum value for calculating sufficiently robust annual mean concentrations and accurate orders of magnitude for annual changes in these concentrations.

❖ Recommendations regarding pesticide residues can be found in the ANSES Opinion of 2 April 2014, available at the following address: https://www.anses.fr/fr/system/files/AUT2013sa0138.pdf

❖ The data from the 2017 MP/CPs relating to veterinary drug residues required efforts to harmonise and understand the databases. They are currently being processed. The results of this work will be made available to the supervisory ministries in 2019 in order to enable them to plan the MP/CPs as efficiently as possible and target compounds of the greatest health concern.

4. AGENCY CONCLUSIONS AND RECOMMENDATIONS

ANSES endorses the conclusions and recommendations of the CES.

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[22] Battilani P, 2018. Impacts of climate change on mycotoxins in Europe. Journées Mycotoxines. Bordeaux, (INRA). Introductory conference
Moretti A, Pascale M, Logrieco AF, 2018. Mycotoxin risks under a climate change scenario in Europe. Trends in Food Science and Technology (in press)
Van des Fels-Klerx HJ, Liu C, Battilani P, 2016. Modelling climate change impacts on mycotoxin contamination. World Mycotoxin Journal, 9(5): 717-726

ANSES underscores that there are limitations related to the quality of the available MP/CP data, which may prevent the state of contamination in the food chain from being accurately described. In addition, ANSES reiterates that the recommendations in this work are related to the control provisions applicable under the regulations in force in 2014, at the time the request was being examined. Therefore, certain recommendations resulting from the expert assessment work may already have been applied through regulatory changes or updates that were not taken into account in the analysis.

ANSES reiterates that these conclusions, based on the documentation of risks and hazards, are not capable of integrating emerging hazards, which require a dedicated approach and resources due to the lack of knowledge on exposure to these hazards and their health impacts. This involves the monitoring and collection of signals by structured vigilance networks, the existence of European and international exchange networks on emerging risks, etc.

In response to the initial request to optimise controls for chemical contaminants with a view to increasing the efficiency of public policies relating to food safety, ANSES has provided a review of control levels by hazard and group of foods, in the form of dashboards, and has identified proposals for improvements.

While confirming the relevance of the general framework in place, ANSES has underlined the importance of making strategic control choices (choice of hazards, choice of foods) on the basis of expert risk assessments. It has proposed a decision tree for prioritising the control of chemical contaminants. Thanks to this tool, ANSES has identified practical approaches for either relaxing or strengthening the control system, as well as needs for the establishment of new monitoring and control measures, all with the aim of improving the control of chemical contaminants in food.

ANSES has thus provided risk managers, in the context of the regular updating of the measures in the Multiannual National Plan for Official Controls (PNCOPA) on chemical contaminants in food, with a practical risk-based method guiding control choices, as part of an approach complying with European legislation on official controls for food.

This guidance constitutes the science-based component of the development process for monitoring and control programmes, into which the responsible authority can integrate other considerations (crises, cyclical choices in light of an emerging risk, local production requirements, etc.).

These conclusions may also contribute to the development of the food chain monitoring platform created by Ministerial Order No. 2015-1242.

Lastly, the conclusions of this Opinion provide a basis for the third component of ANSES's work initiated at the request of the ministries following the CIMAP audit, dealing with the classification of food hazards, by simultaneously considering biological and chemical risks.

Dr Roger Genet

Annexes

Annex 1: Presentation of the participants

FOREWORD: The expert members of the Expert Committees and Working Groups or designated rapporteurs are all appointed in a personal capacity, *intuitu personae*, and do not represent their parent organisation.

WORKING GROUP

Chair

Mr Fabrice NESSLANY – Laboratory Director – expertise in toxicology, risk assessment and genotoxicity

Members

Ms Nicole HAGEN-PICARD – Teacher-Researcher – expertise in toxicokinetics, physiology and reproductive pathology

Ms Laila LAKHAL – INRA Engineer – expertise in toxicology

Ms Raphaële LE GARREC – Teacher-Researcher – expertise in toxicology

Mr Eric MARCHIONI – University Professor – expertise in analytical chemistry of foods and medications

Mr Alain PERIQUET – University Professor – expertise in toxicology, nutrition and food safety

Mr Alain-Claude ROUDOT – University Professor – expertise in mathematical modelling and exposure assessment

EXPERT COMMITTEE

The work covered in this report was monitored and adopted by the following Expert Committee (CES):

CES on "Assessment of physical-chemical risks in food" (2015-2018)

Chair

Mr Cyril FEIDT – University Professor – expertise in the transfer of contaminants

Members

Mr Claude ATGIE – University Professor – expertise in toxicology

Mr Pierre-Marie BADOT – University Professor – expertise in the transfer of contaminants

Mr Jacques BELEGAUD – Honorary Professor – expertise in toxicology

Ms Valérie CAMEL – University Professor – expertise in analytical chemistry

Ms Martine CLAUW – University Professor – expertise in toxicology

Mr Guillaume DUFLOS – Laboratory Manager – expertise in analytical chemistry

Ms Camille DUMAT – University Professor – expertise in analytical chemistry

Mr Jérôme GAY-QUEHEILLARD – University Lecturer – expertise in digestive impacts and metabolism

Mr Thierry GUERIN – Research Director – expertise in analytical chemistry

Ms Nicole HAGEN-PICARD – University Professor – expertise in toxicology

Ms Laila LAKHAL – Engineer, Project Coordinator – expertise in toxicology

Mr Claude LAMBRE – Retired – expertise in toxicology

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Mr Eric MARCHIONI – University Professor – expertise in analytical chemistry

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Mr Eric VERDON – Laboratory Manager – expertise in analytical chemistry

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CES on "Assessment of physical-chemical risks in food" (2018-2021)

Chair

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Vice-Chairs

Mr Fabrice NESSLANY – Laboratory Director – expertise in toxicology, risk assessment and genotoxicity

Ms Karine TACK – Laboratory Manager – expertise in analytical chemistry and toxicology

Members

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Mr Pierre-Marie BADOT – University Professor – expertise in the transfer of contaminants and ecotoxicology

Ms Martine CLAUW – University Professor – expertise in toxicology and veterinary medicinal products

Ms Marie-Yasmine DECHRAOUI – Researcher in Environmental Toxicology – expertise in biotoxins and environmental toxicology

Mr Nicolas DELCOURT – Lecturer and Hospital Pharmacist – expertise in clinical toxicology, biochemistry and neurosciences

Ms Christine DEMEILLIERS – Lecturer – expertise in toxicology and nutrition

Mr Erwan ENGEL – Research Director – expertise in analytical chemistry

Mr Jérôme GAY-QUEHEILLARD – Lecturer – expertise in digestive impacts and metabolism

Mr Petru JITARU – Head of Unit – expertise in analytical chemistry

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Ms Emilie LANCE – Lecturer – expertise in biotoxins and ecotoxicology

Ms Caroline LANIER – Lecturer – expertise in health risk assessment and food risk management

Ms Raphaële LE GARREC – Lecturer – expertise in toxicology, biotoxins and regulations

Mr Ludovic LE HEGARAT – Toxicologist – expertise in predictive toxicology and genotoxicology

Mr Nicolas LOISEAU – Research Manager – expertise in metabolic biochemistry, chemistry and molecular biophysics

Mr David MAKOWSKI – Research Director – expertise in agronomy, statistics and modelling

Mr Eric MARCHIONI – University Professor – expertise in analytical chemistry

Mr Jean-François MASFARAUD – Lecturer – expertise in ecotoxicology and health risk assessment

Mr César MATTEI – Lecturer – expertise in toxicology

Mr Alain-Claude ROUDOT – University Professor – expertise in mathematical modelling and exposure assessment

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Scientific contribution
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Mr Gilles RIVIERE – Deputy Head of Unit – ANSES

Mr Sébastien GORECKI – Scientific Project Leader – ANSES

Mr Jean-Cédric RENINGER – Scientific Project Manager – ANSES

Ms Sandra FAVRET – Scientific Project Leader – ANSES

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French Directorate General for Competition, Consumer Affairs and Fraud Control

Mr Claude DUCHEMIN

Ms Patricia DILLMANN

Ms Claire SERVOZ

Mr Emmanuel KOEN

Ms Dominique CHAMPIRE

Mr Frédéric LAGNIEZ

National Reference Laboratory

Mr Thierry GUERIN

Annex 2: Lists of substances

of concern for which monitoring should be considered

1	BOTANICAL IMPURITIES AND PHYTOTOXINS

- Cyanogenic glycosides in apricot kernels (EFSA, 2016)[23], primarily amygdalin (cyanogenic glycoside).
- Erucic acid, especially in processed foods such as fine bakery products and food for infants and young children, as well as in products of animal origin (meat, milk, eggs).

2	SUBSTANCES OF CONCERN DERIVED FROM FOOD CONTACT MATERIALS

- Mineral oils (MOHs), which are complex mixtures derived from crude oil consisting of mineral oil saturated hydrocarbons (MOSHs) and mineral oil aromatic hydrocarbons (MOAHs), including certain genotoxic and mutagenic MOAHs (especially 3-7-ring MOAHs) (EFSA, 2012[24]; ANSES, 2017[25]).
- Ink photoinitiators (especially benzophenone, 4-methylbenzophenone (4-MBP), 4-hydroxybenzophenone (4-HBP), 4-benzoylbiphenyl (PBZ) and 2-isopropylthioxanthone (ITX)).
- BADGE, used as a monomer in the manufacture of epoxy coatings or as an additive to stabilise vinyl organosol coatings.
- The main alkylphenols used in food packaging (nonylphenols and 4-tert-octylphenol).

3	PHYCOTOXINS

- ❖ Ciguatoxins (CTXs)

- ❖ Pinnatoxins (PnTXs)

- ❖ Palytoxins (PLTXs)

- ❖ Brevetoxins (BTXs)

- ❖ Tetrodotoxins (TTXs)

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[23] EFSA, 2016. Scientific opinion on the acute health risks related to the presence of cyanogenic glycosides in raw apricot kernels and products derived from raw apricot kernels. EFSA Journal 2016;14(4):4424

[24] EFSA, 2012. Scientific Opinion on Mineral Oil Hydrocarbons in Food. EFSA Journal 2012;10(6):2704

[25] ANSES, 2017. Opinion of the French Agency for Food, Environmental and Occupational Health & Safety on the migration of mineral oil compounds into food from recycled paper and cardboard packaging. https://www.anses.fr/fr/system/files/ESPA2015SA0070.pdf

4   MYCOTOXINS

❖ *Beauvericin (BEA) and Enniatins (ENN A, A1, B, B1)*

❖ *Alternaria toxins*

❖ *Masked mycotoxins*

There may be masked forms of mycotoxins in various foods. The European Commission recently reviewed work in progress on the mycotoxins assessed by EFSA, noting that all future work on mycotoxins will take into account modified/masked forms. The EU will examine fumonisins, trichothecenes and zearalenone and would like to be informed if other countries also consider modified forms of mycotoxins.

5   BROMINATED FLAME RETARDANTS

This brominated flame retardant category includes "emerging" BFRs, which are those found in materials and/or goods as well as in wildlife, foods and human beings, whereas "new" BFRs are those that have only been detected in materials and/or goods, but not in wildlife, foods or human beings. To date, 17 "emerging" BFRs and 10 "new" BFRs have been listed:

❖ *"Emerging" BFRs:*

- Tris(2,3-dibromopropyl) phosphate (TDBPP, CAS No 126-72-7)
- Bis(2-ethylhexyl)tetrabromophthalate (BEH-TEBP, CAS No 26040-51-7)
- 2-ethylhexyl 2,3,4,5-tetrabromobenzoate (EH-TBB, CAS No 183658-27-7)
- 1,2-Bis(2,4,6-tribromophenoxy)ethane (BTBPE, CAS No 37853-59-1)
- Decabromodipenyl ethane (DBDPE, CAS No 84852-53-9)
- 4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane (DBE-DBCH, CAS No 3322-93-8)
- 5,6-Dibromo-1,10,11,12,13,13-hexachloro-11-tricyclo[8.2.1.02,9]tridecene (DBHCTD, CAS No 51936-55-1)
- 1,2,3,4,5,6-Hexabromobenzene (HBB, CAS No 87-82-1)
- 1,2,3,4,7,7-Hexachloro-5-(2,3,4,5-tetra-bromophenyl)-bicyclo[2.2.1]hept-2-ene (HCTBPH, CAS No 34571-16-9)
- Octabromotrimethylphenyl indane (OBTMPI, CAS Nos 1084889-51-9, 1025956-65-3, 893843-07-7, 155613-93-7)
- Pentabromobenzyl acrylate (PBB-Acr, CAS No 59447-55-1)
- Pentabromoethylbenzene (PBEB, CAS No 85-22-3)
- Pentabromotoluene (PBT, CAS No 87-83-2)
- Tribromoneopentyl alcohol (TBNPA, CAS No 1522-92-5)
- 1,3,5-Tris(2,3-dibromopropyl)-1,3,5-triazine-2,4,6-trione (TDBP-TAZTO, CAS No 52434-90-9)
- 1,2,5,6-Tetrabromocyclooctane (TBCO, CAS No 3194-57-8)
- 1,2,4,5-Tetrabromo-3,6-dimethylbenzene (TBX, CAS No 23488-38-2)

❖ *"New" BFRs:*

- 1,3-Bis(2,3-dibromopropyl)-5-allyl-1,3,5-triazine-2,4,6(1H,3H,5H)-trione (BDBP-TAZTO, CAS No 75795-16-3)
- Dibromoneopentylglycol (DBNPG, CAS No 3296-90-0)
- 1-(2,3-Dibromopropyl)-3,5-diallyl-1,3,5-triazine-2,4,6(1H,3H,5H)-trione (DBP-TAZTO, CAS No 57829-89-7)
- Dibromostyrene (DBS, CAS No 31780-26-4)
- N,N'-Ethylenebis(tetrabromophthalimide) (EBTEBPI, CAS No 32588-76-4)

- Hexabromocyclodecane (HBCYD, CAS No 25495-98-1)
- 2-(2-Hydroxyethoxy)ethyl 2-hydroxypropyl 3,4,5,6-tetrabromophthalate (HEEHP-TEBP, CAS No 20566-35-2)
- Tetradecabromo-1,4-diphenoxybenzene (4'-PeBPO-BDE208, CAS No 58965-66-5)
- Tris(tribromoneopentyl) phosphate (TTBNPP, CAS No 19186-97-1)
- Tris(2,4,6-tribromophenoxy)-s-triazine (TTBP-TAZ, CAS No 25713-60-4)

6   NANOPARTICLES AND NANOMATERIALS

In the agri-food sector, nanomaterials are used in additives, colourings, processing aids, active packaging, etc. Interesting though they may be, these applications should not mask uncertainties regarding their fate in the body (absorption, distribution, metabolism, excretion) and their acute, subacute and chronic toxicity (genotoxic, immunotoxic, reprotoxic and carcinogenic effects). The Agency established a Working Group that is currently working on the issue of nanomaterials in food. Its work will be published at the end of 2019.

7   NEWLY-FORMED PRODUCTS

While their presence in food may be difficult to avoid, situations favourable (matrix/process pairs) to their development can be identified, along with control methods, to a degree, by applying good manufacturing practice in the numerous processing stages.

In general, the origin of newly-formed substances in food is still difficult to determine due to their wide chemical diversity. Thus, it appears useful to refer to the methodological approach adopted by the Working Group on "Assessment of substances and processes subject to authorisation (ESPA)" (2018)[26], which aims to select appropriate criteria for the classification of "process/matrix" and "process/material" pairs in the manufacture of foods and food contact materials.

In addition to the newly-formed compounds already studied, the following compounds should also be monitored:

❖ Compounds arising from heat treatments

Acrolein, heterocyclic aromatic amines (IQ, IQoe, MeIQx, DiMeIQx, DMIP, TMIP, PhIP), Hydroxy-methyl-furfural, chloropropanol and esters (1,3-DCP), glycidol and esters, Maillard reaction and lipid oxidation products (oxidised triglycerides and polar compounds)

❖ Compounds arising from fermentation processes

- Biogenic amines (tyramine, cadaverine, putrescine, spermine, spermidine)

❖ Compounds arising from storage processes

- Nitrosamines (NDMA) and nitroso compounds

- Formaldehyde – semicarbazide – benzene

❖ Compounds arising from acid or alkaline treatment processes

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[26] Development of one or more strategies for ranking undesirable newly-formed substances resulting from the use of processing aids in food manufacture, the use of food contact materials and food preparation processes. ANSES Internal Request No 2015-SA-0108. Progress report of 14 June 2018.

 - Chloropropanol and esters (1,3-DCP), glycidol and esters

- Lysinoalanine

- D-amino-acids

❖ Chloroparaffins

These substances are receiving increasing attention from the authorities and the scientific community. They are persistent organic pollutants (POPs) that biomagnify and accumulate in the lipid fraction of animal tissues. Chloroparaffins can also contaminate foods by food contact. A recent study suggested that contamination may occur during cooking in an oven (Gallistl et al., 2018)[27].

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[27] Christoph Gallistl C., Jannik Sprengel J., Vetter W., 2018. High levels of medium-chain chlorinated paraffins and polybrominated diphenyl ethers on the inside of several household baking oven doors. STotEn, 615, 1019–1027