Press Kit

Assessment of the health risks of bisphenol A

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Press Release

Bisphenol A: ANSES demonstrates potential health risks and confirms the need to reduce exposure

After three years of study, **ANSES today published the results of its assessment of the health risks** associated with bisphenol A. This work is accompanied by **three other reports:** an inventory of potential alternatives to bisphenol A, a hazard assessment for other compounds of the class of bisphenols, and a report on the uncertainties surrounding endocrine disruptors.

This work was carried out as part of **a multidisciplinary, adversarial collective expert appraisal,** by a working group specifically focusing on endocrine disrupters, assisted by several of the Agency's expert groups. It was based on a review of all the available international studies and the results of measurement campaigns conducted by the Agency on the presence of bisphenol A in different media to which the population may be exposed.

The Opinion published today confirms the health effects of bisphenol A as identified by the Agency in September 2011, particularly for pregnant women in terms of potential risks to the unborn child. **For the first time, it takes into account an estimate of the population's actual exposure to bisphenol A** not only through food, but also by inhalation *(via* ambient air) and the dermal route (contact with consumer products).

Food contributes over 80% of the population's exposure. The **main sources of dietary exposure** are **products packaged in cans**[1], which account for around 50% of total dietary exposure. The Agency has also identified water distributed in **refillable polycarbonate containers** as a major source of exposure to bisphenol A.

The conclusions of the risk assessment, carried out on the basis of hazards identified from studies conducted on animals and of characterisation of exposure, show a **potential risk to the unborn children of exposed pregnant women.** The identified effects relate to a change in the structure of the mammary gland in the unborn child, that could promote subsequent tumour development. The reporting of these potential risks however comes with a **confidence level described by the experts as "moderate"** with regard to the current state of knowledge and uncertainties.

Moreover, the work also led to the identification of other exposure situations, mainly related to the handling of thermal paper (cash register receipts, credit card receipts, etc.), especially in an occupational environment.

Insufficient knowledge relating to other vulnerable groups, especially young children, meant that the Agency was unable to carry out a risk assessment for these populations.

[1] With no possibility of detecting the presence or absence of a bisphenol A-releasing coating

Following ANSES's previous Opinion of September 2011, the French Parliament adopted **legislation in December 2012 to suspend the manufacture, import, export and placing on the market of any packaging for food use containing bisphenol A.** This new law should lead to a significant reduction in the level of exposure to bisphenol A, and its impact should be assessed over time. In addition, the safety of any substitutes used must also be ensured. In particular, in the absence of additional scientific data, the Agency does not advocate the use of other bisphenols as an alternative to bisphenol A.

The Agency also reiterates the relevance of the consumer recommendations issued in its previous Opinions.

Finally, in order to resolve the various uncertainties identified during this work, the Agency is also issuing various **recommendations** to improve the state of knowledge**:**

In terms of research, ANSES recommends acquiring new scientific data on the toxicity of bisphenol A, in particular for the most vulnerable populations, and improving characterisation of exposure.

In terms of methodology, the Agency recommends reviewing the relevance of using toxicity reference values or tolerable daily intakes for substances for which the periods of vulnerability are not always known, as well as systematically including an interdisciplinary analysis of uncertainties in the risk assessment process.

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1. Framework and objectives of the work conducted by ANSES

In 2009, the French Ministry of Health made a formal request to AFSSAPS[2], AFSSA, AFSSET[3], the InVS and INPES to study the issue of endocrine disruptors in their respective spheres of expertise. Meanwhile, INSERM was asked to conduct an expert appraisal of the effects of chemicals accessible to the general public and their effects on reproduction, by gathering and analysing all the available scientific literature.

On the basis of the substances identified *via* this expertise as being of concern due to their toxicity to reproduction and/or endocrine disrupting action, ANSES received a formal request from the Ministry of Health to:

- rank the substances to be studied in order of priority,
- identify products and articles containing substances toxic to reproduction or likely to be so (including endocrine disruptors),
- analyse and, if possible, quantify the routes by which the general population are exposed to these substances. A specific analysis should be conducted of vulnerable populations and individuals exposed to these substances at work, when using products intended for the general public,
- conduct an assessment of the risks and benefits (expected health benefits of some products).
- consider possible alternatives for products or substances for which a risk could be demonstrated.

This comprehensive study is expected to result in a series of risk assessment reports, each specific to a substance. This work, which will extend over several years, symbolises the role played by ANSES in furthering understanding of chemicals, their hazards and their uses.

Bisphenol A: symbolic of ANSES's work on endocrine disruptors

Concerning bisphenol A specifically, the Ministry of the Environment issued a second request on 18 February 2010, taking into account all other types of toxic effects and not just reprotoxic effects and/or effects related to endocrine disruption.

The first two reports from this work were published in September 2011. They concerned the health effects and uses of bisphenol A. On this occasion, the Agency identified as a priority objective the prevention of exposure of the most vulnerable populations (infants, young children and pregnant or breastfeeding women). It recommended reducing this exposure, mainly through bisphenol A's substitution in food contact materials.

The reports published today bring to a close the assessment of the risks associated with bisphenol A. However, the results of the infant total diet study (TDS) currently underway will provide data to characterise the dietary exposure of children under 3 years old (2014).

Meanwhile, expert appraisal work is currently continuing on other classes of endocrine disrupting substances (phthalates, brominated compounds, phenols, etc.).

[2] Has since become the ANSM

[3] On 1 July 2010, the French Food Safety Agency (AFSSA) and the French Agency for Environmental and Occupational Health Safety were merged to form ANSES

2. How ANSES conducted its work

To conduct its assessment of the risks associated with bisphenol A, ANSES followed the traditional approach currently applied in this area: hazard characterisation, exposure determination and finally risk assessment. However, for each of these steps, the Agency employed innovative mechanisms enabling it to conduct an extremely detailed risk assessment, for the first time taking into account all routes of exposure to bisphenol A: food intake, skin contact and inhalation.

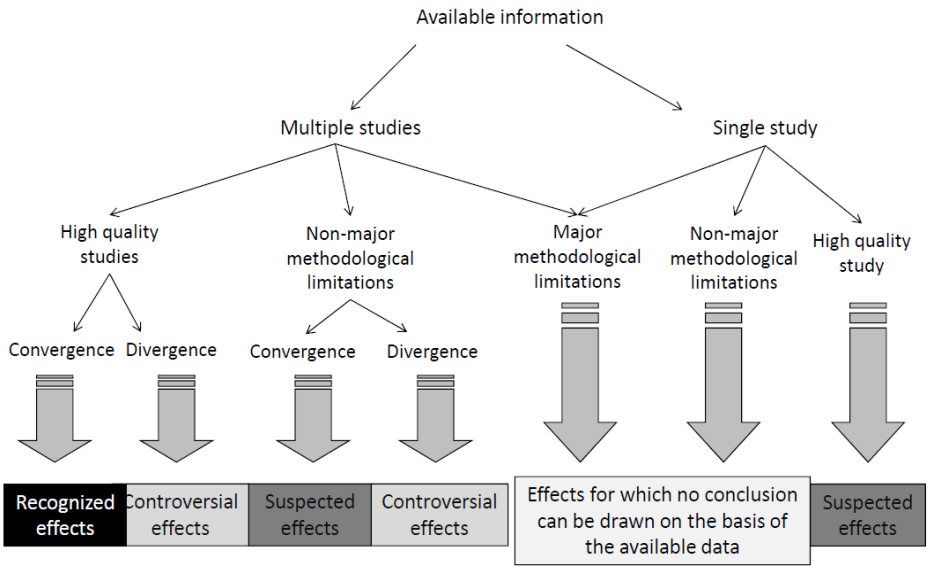
- Characterisation of the hazards of bisphenol A

To determine the critical effects[4] to be used for the risk assessment, the Agency conducted a comprehensive analysis of the scientific literature based in particular on reports by overseas and international organisations (OEHHA, WHO, JRC[5], etc.) as well as those in France (INSERM, 2011). No article was ruled out *a priori.* **Each study taken separately was described as** "high quality", "having non-major methodological limitations," or "having major methodological limitations", in terms of its methodology (consistency of the exposure model, confounding factors taken into account, etc.) and the number of observations.

For each type of effect reported by the studies, the level of evidence was determined by considering the number and "quality" of the studies reporting this effect. Four categories of levels of evidence were defined: recognised effects, suspected effects, controversial effects and effects for which no conclusions can be drawn on the basis of the available data.

The effects of bisphenol A, by organ or system, were therefore categorised in both humans and animals, depending on the periods of exposure. **As no recognised effect had been identified in humans, on the basis of the available studies, the experts chose to refer to effects considered as recognised in animals and/or suspected in humans for the risk assessment.**

Decision tree used to classify the effects of bisphenol A



[4] i.e., the adverse effects occurring at the lowest doses for each organ

[5] Office of Environmental Health Hazard Assessment (California), World Health Organization, European Joint Research Centre, etc.

The analysis of scientific articles on the effects of BPA, published before July 2012 and based on experimental data in animals, helped identify the critical effects deemed to be relevant to the unborn children of exposed pregnant women. **Four types of effects were therefore chosen**: effects on the brain and behaviour, on the female reproductive system, on metabolism and obesity, and the mammary gland.

For each of these organs or biological systems, the experts selected, on the basis of the available data, the critical health effect and the key study to be used for the risk assessment, in order to **determine the toxicological values (TVs) for the effects** (internal dose corresponding to the critical effect considered).

Critical effects	Study reference	Route of exposure	Internal TV (µg/kg/d)
Brain and behaviour	Xu *et al.*, 2010	oral	**0.005**
Female reproductive system	Rubin *et al.*, 2001	oral	**0.01**
Metabolism and obesity	Miyawaki *et al.*, 2007	oral	**0.009**
Mammary gland	Moral *et al.*, 2008	oral	**0.0025**

Ultimately, it was only possible to assess risks to the unborn children of pregnant women, due to the lack of toxicological benchmark doses for the other populations or age groups of interest (infants, young children, adolescents, etc.).

- Determination of exposure

To ensure that the exposure modelling was as comprehensive as possible, a conceptual exposure framework was prepared to list all the potential media and sources of exposure. This work drew firstly on an inventory of uses drawn up by ANSES through an industry survey targeting French businesses, and secondly on an exhaustive literature search that continued until June 2011. Given the many uses and applications of bisphenol A in everyday consumer products, several exposure media are likely to contain it: air, dust, soil and food (including water intended for human consumption). Levels of bisphenol A contamination in these compartments were documented from bibliographic data and specific surveys commissioned by the Agency.

For the purposes of the expert appraisal, specific bisphenol A analysis campaigns were conducted at the request of ANSES, especially in foods (data from the TDS 2 conducted by the Agency), water intended for human consumption (from the public water supply and from bottled water), in the air and dust of housing, and on cash register receipts (thermal paper). In all, several hundred analyses were carried out.

The results of these campaigns were used to model exposure expressed as internal exposure doses according to a probabilistic approach, to better take into account the variability in the target populations. This approach enabled exposure from different media to be aggregated. Internal exposure doses were then calculated taking into account intake from food (including drinking water), ingestion of settled dust and inhalation. Given the available data, the exposure doses were calculated for pregnant women, adults (men and women) and children over 3 years old. Specific exposure scenarios were also developed to take into account exposure from cash register receipts and refillable polycarbonate water containers.

The results of the infant TDS currently being conducted by the Agency will complement this work by providing data on children under 3 years old.

Cosmetics and medical devices were excluded from the expert appraisal because they do not fall within ANSES's sphere of competence.

- Risk assessment

The bisphenol A risk characterisation consisted in comparing the internal doses calculated on the basis of the exposure scenarios and internal benchmark doses selected by the experts. This work assessed the health risks for a single target population, pregnant women and their offspring, and was performed for each of the critical effects considered.

An **analysis of the uncertainties** completed the overall hazard and exposure assessment process. In particular this helped identify the different sources of uncertainty in the expert appraisal, the main purpose being to better characterise the confidence levels assigned to the final results, by ranking them as "high", "moderate" or "limited".

3. Conclusions of the assessment of the health risks associated with bisphenol A

In order to respond to the formal requests from the French Ministries of Health and the Environment, ANSES set up a dedicated working group on Endocrine disruptors and category 3 reprotoxic substances (the WG ED) reporting to the Expert Committee (CES) on Assessment of the risks related to chemical substances. This WG brought together some thirty experts specialising in a variety of different fields. Other Agency CESs and WGs were involved concerning questions falling within their spheres of competence (the CES on Assessment of the risks related to water, the CES on chemical and physical residues and contaminants, the CES on Food contact materials, and the CES on Assessment of physico-chemical risks in food).

The aim of this risk assessment was to incorporate, as broadly as possible, the various potential sources of exposure to bisphenol A (food, air, dust, consumer products, etc.) and to model exposure at the different stages of life, and in certain specific exposure situations (workers, for example).

Given the available data, the exposure doses were calculated for pregnant women, adults (men and women) and children over 3 years old. Specific exposure scenarios were also developed to take into account exposure from cash register receipts and refillable polycarbonate water containers. The analysis of all the scientific articles on the effects of BPA, published until July 2012, helped identify, based on experimental data in animals, the critical effects deemed to be relevant to the unborn children of exposed pregnant women.

Four types of effects were therefore chosen for the risk assessment: effects on the brain and behaviour, on the female reproductive system, on metabolism and obesity, and on the mammary gland.

Conclusions

The risk assessment, which took into account all exposure media (but excluded specific exposure situations), shows that under certain circumstances, the exposure of pregnant women to bisphenol A could pose a potential risk for the unborn child. The identified effects relate to a change in the structure of the mammary gland in the unborn child that could promote subsequent tumour development. The risks potentially affect children of both sexes.

The **confidence level associated with these results was described as "moderate"** by the majority of the experts, given the many uncertainties in the current state of scientific knowledge.

Concerning the other three types of effects examined for the risk assessment (effects on the brain and behaviour, effect on metabolism and obesity, effect on the female reproductive system), the risk appears to be "negligible", depending on the assumptions made.

Sources of exposure

On average, food is the main contributor to exposure (84% for pregnant women). Regarding the main dietary sources of exposure and irrespective of the populations concerned, the expert appraisal identified three broad categories:

- **Products packaged in cans** which account for around 50% of total dietary exposure and are broken down as follows: 35 to 45% for vegetables; 10 to 15% for mixed dishes and meat- and fish-based products.
- Some **foods of animal origin**: approximately 17% for meats, offal and delicatessen meats, between 1 and 3% for seafood.
- **diffuse contamination** whose origin has not been identified, which accounts for between 25 and 30% of total dietary exposure**.**

The calculation of **exposure *via* refillable polycarbonate water containers** shows that water bottled in such containers **is a significant source of exposure** to bisphenol A. Its consumption can contribute to an increase in exposure to bisphenol A and could therefore, when combined with other sources of exposure, lead to an "additional" risk to the unborn child of an exposed pregnant woman.

The specific assessment of risks associated with the handling or use of products and/or articles intended for the general public and containing bisphenol A shows that handling thermal paper receipts leads to potential risk situations for the four types of effects considered in the risk assessment, but with a confidence level considered "limited" by the experts, due to the many uncertainties. It is certainly true that the models and assumptions used lead to overestimating exposure calculated in relation to handling thermal paper receipts. As a result, additional work will be undertaken to more accurately estimate the amount of bisphenol A actually absorbed by the dermal route.

Recommendations

Following ANSES's previous Opinion of September 2011, the French Parliament adopted **legislation in December 2012 to suspend the manufacture, import, export and placing on the market of any packaging for food use containing bisphenol A.** This new law should lead to a significant reduction in the level of exposure to bisphenol A.

In this respect, ANSES recommends:

- **assessing the impact over time of the implementation of these regulations** and **ensuring the safety of any substitutes** used. In particular, in the absence of additional scientific data, the Agency does not advocate the use of other bisphenols as an alternative to bisphenol A.
- the Agency also reiterates the relevance of the **consumer recommendations** issued in its previous Opinions.

Considering the identification of potential risk situations for the unborn children of pregnant women handling thermal paper containing BPA, especially as part of their occupational activities, ANSES recommends:

- taking immediate measures to **reduce the exposure of women handling thermal paper** containing bisphenol A or other compounds of the class of bisphenols, especially in the workplace;
- undertaking, at the first opportunity, **a biometrology study of cashiers and tellers** handling thermal paper containing bisphenol A and/or bisphenol S, in order to verify the results obtained from the exposure scenarios used in this work and to identify the most suitable risk-reduction measures. The Agency undertakes to support such investigations.

The Agency is also issuing recommendations to **advance knowledge** on the toxicity of bisphenol A, in particular for the most vulnerable populations, and improving characterisation of exposure (improving analytical methods, acquiring data on specific media and populations, acquiring data to improve exposure modelling, etc.).

Lastly, **in terms of methodology**, the Agency recommends reviewing the relevance of using toxicity reference values such as the tolerable daily intake for substances for which the periods of vulnerability are not always known, as well as systematically including an interdisciplinary analysis of uncertainties in the risk assessment process.

4. Review of possible alternatives to bisphenol A

Following the work it published in September 2011 on identification of the hazards of bisphenol A, ANSES considered that there was sufficient scientific evidence to identify as its priority a reduction in the exposure of the most vulnerable populations (namely infants, young children, and pregnant and breastfeeding women). This objective involves the **substitution** of bisphenol A in food contact materials, which are the main source of population exposure.
In this context and alongside the continuation of its bisphenol A risk assessment work, in September 2011 the Agency submitted for consultation its reports on the hazards and uses of bisphenol A. At the same time it launched a call for contributions, in order to gather scientific data on the available substitute products, and if possible, on their safety and efficacy. After a summary note published in June 2012, the report published in April 2013 is the culmination of this work. It drew on the results of the call for contributions, on a major bibliographical review and on the collection of information from companies contacted outside the framework of the initial consultation.

An initial detailed 'identity card' of possible alternatives

A total of **73 possible alternatives to bisphenol A were identified**, including four coming directly from the industrial companies responding to the call for contributions, seven from industrial companies contacted outside of the framework of this call for contributions and 62 others from the international literature.

There are many different ways of providing alternatives to bisphenol A:

- Direct substitution of bisphenol A by another substance;
- Substitution by another plastic material or another polymer having similar properties to the starting polymer;
- Substitution by another material, other type of packaging;
- Substitution by a process.

For each of the identified alternatives, the regulatory framework, information on its uses and available toxicological data were reviewed by the Agency. Thus, for each alternative identified, the ANSES report specifies, to the extent that information is available:

- Its identity;
- Its classification according to the regulatory framework relating to the classification, packaging and labelling of hazardous substances[6];
- Its status with regard to the European REACh Regulation (i.e. whether or not the substance is registered and any possible management measures the substance may be subject to);
- Its status with regard to regulations on food contact materials (FCM) and materials in contact with water intended for human consumption (WIHCM), and more specifically its inclusion in or exclusion from Commission Regulation (EU) No. 10/2011;
- Its physico-chemical properties;
- The applications for which it can replace bisphenol A;

[6] Directive 67/548/EC and the CLP Regulation No 1272/2008

- The advantages and disadvantages presented by this alternative; their descriptions in the report are based on the available bibliographic data and/or data provided by the manufacturers who provided an example of substitution. This information is presented for information only and cannot be regarded either as exhaustive or as validated by ANSES, since it has not been assessed by the Agency.

- Feedback from industrial companies when it is available and can be published.

Conclusions

This identification work, conducted until March 2012 and described in this report, made it possible to draw up an **initial inventory of potential alternatives to bisphenol A and substitutions for bisphenol A by use**.

Although scientific and technical information was collected for certain identified alternatives, it is important to note that, while **some of these alternatives are currently in use both on European and non-European markets, others are still at an early stage of research and development**. It should also be emphasised that the list of existing alternatives identified is probably not exhaustive.
Following this initial work, it should be noted that **no single alternative stood out for replacing bisphenol A for all of its uses**. Some questions remain regarding the safety, feasibility and efficacy, in technical terms, of these alternatives.

The Agency's objective in this work was solely to make an inventory of existing potential alternatives to bisphenol A, and it by no means aimed to assess or validate the identified or submitted proposals, particularly with regard to the health risks. No assessment or value judgment was therefore made for the identified alternatives, whether on their technological feasibility, toxicology data, or their advantages and disadvantages.

In addition, the review of the available data on the toxicity of the potential alternatives to bisphenol A indicates that, even though most of these chemical compounds have been (pre)registered under REACh, **they have not yet undergone thorough toxicological testing,** particularly as relating to reproduction and/or their endocrine disruptive qualities. Finally, the search for alternatives is an evolving field of study and the information on this subject needs regular updating.

5. Assessment of the hazards of other compounds of the class of bisphenols

The Ministry of Health's request called for an expert appraisal of a number of substances, including the bisphenols B and M (BPB and BPM), and bisphenol A diglycidyl ether (BADGE), with regard to their potential endocrine disrupting nature. Moreover, the ongoing work on the bisphenol A request made clear the relevance of investigating other compounds such as bisphenol S (BPS), bisphenol AF or AP, identified as potential substitutes for bisphenol A.

A specific report was produced to assess the potential hazards of these various substances and the possibility of conducting a health risk assessment.

For this purpose, a literature search was conducted to draw up a toxicological profile of each of these compounds, and an industry survey was also conducted for bisphenol S, BADGE, bisphenol B and bisphenol M, in order to identify the associated products.

Conclusions

All these substances share a common chemical structure with the compounds of the class of bisphenols, **which gives them oestrogenic properties,** i.e., similar to oestrogens, which are hormones synthesised mainly by the ovaries and involved in regulating the menstrual cycle, pubertal development and subsequent maintenance of physical female characteristics, as well as during growth (formation and solidification of the bone matrix).

Particular care should therefore be exercised when using bisphenols S, F, M, B, AP, AF and BADGE in certain areas, as the oestrogenic activity common to this class of compounds may be harmful to the consumer.

According to the conclusions of the toxicological profiles of the compounds tested, and subject to a more detailed analysis of their use, further studies are needed to assess their hazards in order to obtain more complete and comparable toxicological profiles. The Agency has therefore formulated research recommendations for each individual substance to complement the data on their toxicity.

Concerning **the uses of these bisphenols**, of the seven compounds analysed in this report, three, BPS, BPF and bisphenol AP, are potential substitutes for bisphenol A. According to ANSES's study report on alternatives to bisphenol A, these three compounds are used as substitutes for bisphenol A as developers in thermal paper. BPS is used as a starting monomer for the synthesis of polyethersulfone (PES), which is specifically used for the manufacture of infant feeding bottles and children's tableware. The other compounds (BPB, BPM, bisphenol AF and BADGE) were not identified in this report as substitutes for bisphenol A. The information gathered thus far suggests that BPB, BPM and bisphenol AF are used for the synthesis of polymers. For its part, BADGE is employed in the synthesis of certain epoxy resins that may be used in the internal coating of food containers.

Recommendations

It is apparent from the work conducted by the Agency that at the present time, **the available toxicological data are insufficient** for assessing the toxicity of bisphenols M, S, B, AP, AF, F and BADGE. Similarly, **data on preparations and/or articles** containing bisphenols M, B, S and BADGE, **as well as those on potential environmental contamination caused by these compounds, are too fragmentary** to enable the general population's exposure to be assessed.

As a result, it is not possible to assess the health risks associated with the use of these compounds in consumer products, and **the greatest care should therefore be exercised with regard to substitution by these compounds**.

6. Representations of the uncertainties surrounding endocrine disruptors

As part of the work it has been carrying out on endocrine disruptors and bisphenol A, the Agency set up a sub-working group on "uncertainties and society" within the working group on endocrine disrupters. This sub-group was asked to examine the social and scientific representations relating to the uncertainties surrounding the issue of endocrine disruptors.
In this regard, about a dozen hearings were conducted in order to take the general public's views into consideration and shed light on its questions about endocrine disruptors.

This original approach of openness to stakeholders and of summarising the positions of the various parties in the controversy was intended to help characterise the various certainties and uncertainties surrounding endocrine disruptors, thereby pinpointing more precisely certain key areas of the controversy.
The notion of uncertainty refers here to a situation where the available body of knowledge on a particular topic – such as the toxicological effects of endocrine disruptors – is regarded as little known or unknown, incomplete, incorrect, biased, unconvincing, etc. The aim of the hearings was to further the scientific debate on the characterisation of uncertainty and to document how the stakeholders' positions echoed the scientific questions.
Two other objectives were also pursued: to characterise the spectrum of actions considered relevant in answer to the issue of endocrine disruptors, and to understand the personal experiences that have contributed or are contributing to the public definition of endocrine disruptors as "presenting a risk".

Conclusions

Following these hearings, it became clear that the declarations of the individuals interviewed and the concepts they relied on to explain the sources of uncertainty all reflected the complexity of the issue of endocrine disruptors. The diversity of definitions of endocrine disruptors that co-exist already illustrates one of the difficulties of dealing with the issue. Depending on the definition adopted, the substances, effects and methods differ, along with the way the issue is understood. **This lack of consensus is a problem when implementing research, the health risk assessment and the introduction of a regulation.**

The hearings highlighted the debate **surrounding the effects at low doses and the non-monotonic dose-response relationships**, illustrating the broader reservations concerning the toxicology paradigm. Conventionally accepted elements were discussed, such as extrapolation from animals to humans or the relevance of the tests used. Several of the individuals interviewed raised the question of the **effects of mixtures of substances**, and the ways of measuring these effects were discussed and added to the uncertainties surrounding endocrine disruptors. The issue of the **trans-generational effects** of endocrine disruptors and, in this context, the role of epigenetic pathways was raised. These discussions led to the issue of regulatory measures, actions to be undertaken and general research methodologies.

What emerges from all the hearings is a social and scientific construct of the uncertainties, sometimes by consensus (on the lack of knowledge or lack of robustness of the available methods), and other times by opposition (concerning the scientific paradigm and associated best practices that should be applied). However, there is a certain amount of moderation and relatively little contrast between the remarks and positions, where standpoints could have been more pronounced.

Ultimately, the issue of uncertainty around endocrine disruptors is found in various schools of thought, emphasising personal and/or professional considerations and/or positions that cut across current social and political questions/debates on this topic. Thus, **the primary value of these hearings has been to show that the field of endocrine disruptors now largely extends beyond the purely scientific field since it has become a widespread social, ideological and political debate**.

7. Food containers and bisphenol A: practical guidance

In terms of food-grade plastics, bisphenol A is currently used for:

- the manufacture of a plastic, polycarbonate, which is hard, transparent, recyclable, etc. It may be likened to other materials such as plexiglass or polypropylene, for instance.
- the manufacture of certain epoxy resins, used as a varnish coating inside certain food containers. Such coatings are used to protect metal packaging and form a continuous, very thin layer of film.

In the absence of clear labelling on containers, it is very difficult to be sure of the absence of bisphenol A. However, in the most common cases, the following principles can be used to determine the food containers most likely to be a source of bisphenol A:

How to recognise a polycarbonate utensil

Marking of food-grade plastic is not currently mandatory although it is commonly practiced by manufacturers. The pictogram inside which the numbers 1-6 are shown confirms that the material is not polycarbonate. When the number 7 is shown (see below), corresponding to "other plastics", the material may be composed of a wide range of plastics, unless the initials PC appear below it, indicating that it is polycarbonate. Without such special marking, polycarbonate is difficult to distinguish with certainty from other rigid plastics. This compound may be present in a variety of kitchen utensils: blenders (mixers), airtight microwaveable containers, pressure cooker liners, pastry piping tubes, pitchers, refrigerator trays, etc.

How to recognise cans likely to contain bisphenol A

It is currently very difficult to identify with certainty those metal containers likely to contain bisphenol A. Industrial practices, particularly in France, have probably evolved following the discussions on this compound, potentially leading to a reduction in the use of bisphenol A. However, it can be stated that:

- Foods presented in glass jars typically do not contain bisphenol A (with the possible exception of the coating present on the lid).

- Metal food containers (drink cans, rectangular tins, cylindrical tins, etc.) can be classified into two categories:

    - Products in principle without bisphenol A: “2-part” containers consisting of a body obtained by stamping a metal sheet, and a lid that is crimped after filling, which is typically the case with drink cans;
    - Other products: metal containers consisting of “3 parts”: a body and 2 crimped parts (base and lid). This is mainly the case with cylindrical tins. In these containers, the presence of bisphenol A is possible, and more likely if the food concerned is acidic.

Potential food sources of exposure to bisphenol A:

- Consumption of products packaged in cans likely to contain bisphenol A (particularly foods reheated directly in such cans),
- Food use of utensils or containers without markings that could rule out the presence of polycarbonate (i.e. 1-6), and in particular:
    - Prolonged storage of food in such containers;
    - Use of damaged containers (scratched, worn, etc.);
    - Reheating products in the microwave in reusable containers likely to contain bisphenol A, or cooking with equipment where food is in contact with polycarbonate (steamers, etc.).