Bisphenol A

What is Bisphenol A?

Bisphenol A (BPA) is a synthetic chemical first synthesised in 1891. The chemical structure of BPA shows similarity to that of Diethylstilboestrol (DES) (1), formerly used as a drug to treat women with gynaecological problems and to help prevent miscarriage and which is now classified as a group I carcinogen by the International Agency for Research on Cancer (IARC).

BPA was identified as being an artificial oestrogen as early as 1930 (2). Its use in plastics production began after World War II, when it was found to react with phosgene and yield a clear, hard plastic - polycarbonate.

Over 3 billion kilograms of BPA are produced each year. In 2010, BPA was estimated to be worth around £350,000 an hour to the global economy (3). The production of BPA has increased by 500% in the last three decades and continues to rise.

Where is it found?

BPA is used in the manufacture of polycarbonate plastic food and drink packaging, and in epoxy resins that line some metal cans of food and drink. It is also used as an additive in polyvinyl chloride (PVC) plastics, and is found in CDs, mobile phone and computer casings, glasses, dental sealants, medical devices (4) as well as thermal till receipts, where it's used as a colour developer.

Why should we be concerned?

BPA is able to migrate. It can rub off onto hands, leach into food and drink contents (5) and is absorbed through the skin.

Exposure to ultraviolet light, high temperatures (such as those used in sterilisation processes), or to acidic conditions (for example, in a can of tinned tomatoes), will increase leaching.

BPA is ubiquitous. It is found all over the planet in ecosystems and wildlife (6). It is estimated to be present in over 93% of the adult population (7) and has been found in human urine samples (8), human serum (9), sweat (10), placental tissue (11), ovarian follicular fluid and evidence suggests it accumulates over time in human amniotic fluid (12). It has also been found in human breast milk (13), which confirms its presence in the breast, and at even higher levels in liver, brain and human fat tissue (14).

There is sufficient evidence to suggest that dietary exposure is the main route of human exposure to BPA, along with regular contact with thermal receipt paper (15).

Whilst proponents of BPA claim that it is safe to use because human levels of exposure are low, evidence suggests that BPA is harmful even at very low levels of exposure (16, 17). BPA gives rise to ‘non monotonic’ dose responses, which means that it has varying effects at different doses. Therefore, the application of so-called Tolerable Daily Intakes (TDIs) (18) of BPA, which have been

predicted from higher doses to permit its continued use in everyday products may well be unsafe for the consumer.

How is BPA linked with breast cancer?

There is a significant amount of scientific evidence that shows even low level exposure BPA has an adverse effect on the development of breast tissue. Laboratory experiments show that BPA has the ability to transform normal breast cells into cells of a more cancerous or overall malignant nature (19, 20, 21). Animal studies show that exposure to BPA in the womb, or during early life, can increase breast density, cell growth and increase susceptibility to tumours (22, 23, 24, 25, 26, 27). BPA has also been found to trigger DNA strand breaks, to interfere with cell division (28, 29) and with chemotherapy, making it less effective against breast cancers (30).

Like DES, BPA is a synthetic oestrogen and is able to bind to oestrogen receptors both within and on the cell surface. BPA is therefore able to influence how genes and cells behave. Mammary tissues are primed to respond to the presence of oestrogen in order to develop and grow and, therefore, bind easily to BPA.

What is the current regulatory position on BPA?

The European Commission decided to ban the use of BPA in baby bottles in March 2011 (31), because of concerns about the adverse effect of BPA on human health. It continues to be used, however, in a wide range of other food and drinks packaging.

France took unilateral action in December 2012 to ban the use of BPA in food and drinks packaging and in thermal receipt paper (32). The ban, which came into force in January 2015, has since been partially overturned by the country's courts (33). Sweden, Denmark and Belgium have also taken measures to reduce the use of BPA, in products marketed at children under three years old.

The EU adopted a new regulation in September, 2016, which specifies a limit of 0.05mg/kg for BPA in materials that come into contact with food, "to protect human health". The previous limit was 0.6mg/kg. In December 2016, the European Commission decided to restrict BPA in thermal paper in the EU. This ban will take effect in 2020.

The European Food Safety Authority's (EFSA) most recent review of BPA exposure and toxicity concluded that "BPA poses no health risk to consumers of any age group (including unborn children, infants and adolescents) at current exposure levels", but acknowledged that high levels of exposure may adversely affect the kidney, liver and mammary gland, and recommended the TDI be reduced from 50 µg/kg of bw/day to 4 µg/kg of bw/day (34). They also stated that there are "remaining uncertainties about BPA's toxic effects" and a further re-evaluation will be carried out when the results of long-term research by the US National Toxicology Program are available for evaluation, in one or two years time.

In February 2016, the European Commission and member states agreed to classify BPA as a category 1B presumed reproductive toxicant (35), meaning it is a substance which can adversely affect the human reproductive system. The EC Committee's decision follows that of the state of

California, which last year added BPA to its proposition 65 list of chemicals that are known to cause cancer, birth defects or other reproductive harm (36).

BREAKING NEWS: On 16th June 2017, the Member State Committee (MSC) of ECHA supported the French proposal to additionally identify Bisphenol A as a substance of very high concern because of its endocrine disrupting properties which cause probable serious effects to human health (37). Listing BPA as a SVHC is the first step in the procedure for restriction of its use and could result in more stringent regulatory measures. There would also be an obligation to implement stronger preventative measures for professional use, principally by using substitutes.

As a direct result of BPA's identification as an SVHC,manufacturers will now have to notify ECHA of the presence of BPA in all imported or manufactured items and must also inform consumers, upon request, when items contain the substance. BPA's inclusion on the list of substances of very high concern means that its uses may be limited and subject to the granting of a temporary, renewable authorisation.

FURTHER UPDATES: ECHA has just announced it will consider recommending the European Commission include BPA in the Authorisation List (Annex XIV to REACH). If included BPA will only be placed on the market or used after a given date if an authorisation is granted for a specific use. Breast Cancer UK supports fully this recommendation.

In a separate development EFSA announced a new working group of scientific experts will start evaluating recent toxicological data on BPA in food contact material. Details on this new assessment are due in 2020. Breast Cancer UK is calling for BPA to be prohibited from use in all food and drinks packaging, including food contact materials which come under EFSA regulation.

Discover More

Breast Cancer UK has submitted responses to numerous consultations conducted by the European Chemicals Agency and the European Food Safety Authority regarding the safety of BPA and its use in products including food contact materials. See here for details of these consultation responses.

For a list of references cited please see here. For more information download our full background briefing on the right hand side of this page.

Page last updated 6 November 2018