INTRODUCTION:

EL-Science are providers of technical solutions to the electronic cigarette industry. Dedicated solely to eLiquid analysis and manufacture, EL-Science is one of the most experienced e-cigarette testing and manufacturing laboratories in Europe. With a leading team of scientists comprised of analytical, flavour, organic and toxicology chemists, EL-Science works closely in conjunction with their toxicological consultants, Bibra Toxicology Advise and Consulting.

EL-Science strongly feels that the quality of eLiquid across the UK can be enhanced through controlled production processes, tested and regulated vaping products, and good scientific research.

The Analytical Laboratories are specifically equipped to provide a full analytical service to ensure that tested eLiquids are compliant with Article 20 of the Tobacco Products Directive (TPD) (2014/40/EU), which came into effect in May 2016. Multiple methods of chemical analysis are applied to identify the compositional components of each eLiquid product, including gas chromatography-mass spectrometry (GC-MS), high performance liquid chromatography (HPLC) and inductively coupled plasma-mass spectrometry (ICP-MS). This allows for both the qualification and quantification of hundreds of flavour ingredients, as well as potentially harmful additives and undesirable contaminants. Emissions testing is performed using in-house developed electronic cigarette vapour collection device and using hardware, power settings and puff profiles that are relevant to and representative of the product being tested and that realistically simulate an end product user.

Once the product ingredients have been identified by the Analytical Team and the concentrations of each determined, they are risk assessed toxicologically by the Flavour Team, who not only consider the health implications to the end user of each individual ingredient present, but examine the additive effects of all the ingredients present together to assess the full eLiquid product as a whole.

EL-Science and Bibra have determined Health Criteria Values (HCVs) for all chemicals which have been identified as having the potential to be detrimental to human health. These have been established by reviewing evidence from occupational and epidemiological studies, laboratory animal studies, and also, where available, from an understanding of the chemical’s ADME (adsorption, distribution, metabolism, and excretion) and mechanism/mode-of-action. While assessment of HCVs is above and beyond the requirements of the TPD, EL-Science strongly believe that is an essential requirement of the General Product Safety Regulations 2005.

If a product does not meet the toxicological requirements, EL-Science can reformulate it for the Customer. The focus is on maintaining the flavour profile of the eLiquid as much as possible to maintain its originality, ensuring the integrity of the product’s sensory profile, whilst reducing or entirely eliminating the compounds of toxicological concern.

KEY POINTS TO ADDRESS:
1. The impact on human health of e-cigarettes – themselves and relative to ‘conventional’ smoking – and any gaps in the science knowledge-base in this area.

EL-Science provide a comprehensive TPD/TRPR service to eliquid manufacturers and importers, and have studied thousands of eliquid products as a result.

A basic principle of toxicology is “the dose makes the poison”. This is true for all components in an eliquid and can be compared to the food industry and recommended daily allowances. For example, it is recommended that adults should not be eating more than 6g of salt a day.
Diacetyl and acetylpropionyl and the health implications of their inclusion in eliquids is well known within the industry. These diketones are generally found in creamy, buttery flavours, as well as in some fruits, and they can lead to a disease called Bronchiolitis Obliterans. While these compounds are on the MHRA’s banned ingredient list, there is no guidance offered with regard to threshold concentrations for reporting. This is a significant problem because analytical identification of the presence or lack thereof of a compound is restricted by the detection limit of the method of identification used or the quantitation limit reported. The result of different testing laboratories using different methods of analysis with different sensitivities is that there are products on the market now that contain these banned ingredients at concentrations of toxicological significance, despite being them being reported as “diketone free” and despite them having been accepted as “TPD compliant”.

With Bibra, we have created 273 toxicity monographs and a further 43 HCV monographs. This involved initially searching for existing toxicity data in a range of data sources, reviewing the literature, and (where the data were considered key) briefly summarising that information. These literature reviews include sections on Irritation, Sensitisation, Acute and Repeated dose toxicity, Genotoxicity, Carcinogenicity, Reproductive and Developmental toxicity (i.e. CMR properties), Cardiopulmonary effects, and Addictiveness. The monographs focus on the inhalation route of exposure, but exclude data on cigarette smoke. EL-Science also commissioned Bibra to determine tolerable threshold levels (described in the relevant monographs as Health Criteria Values; or HCVs) for the toxicologically worst-case representative substance(s) in each structural class, where the data allowed. Where necessary (and possible from the data available), thresholds for local and systemic toxicity (cancer and non-cancer) were considered, and the lowest (i.e. most health precautionary) proposed. Exiting HCVs (e.g. OELs, US EPA RfCs, ATSDR MRLs, EFSA/JECFA ADIs/TDIIs, etc.) already determined by Expert Groups were considered, as were ADME considerations, etc. Preferentially, these HCVs were determined on the basis of suitable points-of-departure (e.g. N/LOAEL/Cs) from reliable repeated-dose inhalation studies (human or laboratory animal), with the application of appropriate safety/uncertainty/ assessment factors (primarily using ECHA REACH guidance as a basis). Where no inhalation studies were available, the use of studies involving other exposure routes (e.g. oral data) were considered, and appropriate route-to-route extrapolation factors introduced where needed. These HCVs were then converted to tolerable levels in the eliquid (for PG- and VG-based formulations) based on assumptions regarding daily intake provided by EL-Science. Over 200 eliquid ingredients can be associated with the determined health criteria values.

EL-Science have found that 24% of the thousands of products that we tested contained ingredients above their health criteria values, and are happy to provide additional detail on these findings to regulators and decision-makers.

The main cause of concern here from EL-Science’s perspective is that these flavour chemicals, and importantly, the concentration of these chemicals present in nicotine containing AND non-nicotine containing eliquid products are not being taken into consideration by the regulators.

2. The safety of e-cigarette devices, and any safety regulation requirements.
3. The impact to date of the Tobacco and Related Products Regulations on the vaping industry and on the prevalence of e-cigarettes.

EL-Science very strongly believe that zero nicotine products should fall under TPD/TRPR regulations. The primary reasoning behind this is that while there is a strong understanding of the health implications around nicotine when inhaled, manufacturers and regulators are not taking flavour
ingredients and their associated health criteria values into account when producing and assessing eliquid products.

Many large and small eliquid manufacturers have spent hundreds of thousands to millions of pounds to ensure TPD/TRPR compliancy. However, the industry is now facing a new business critical challenge. A ‘loophole’ in the regulations has been found in the form of shortfills, i.e. 50 or 100 ml of zero nicotine eliquid being sold in a slightly larger bottle, allowing for one or more 18 mg/ml unflavoured “nicotine shots” to be added, thus creating a 3 or 6 mg/ml eliquid product. The MHRA recently confirmed that because these shortfill products do not contain nicotine, they do not fall under the remit of the TPD/TRPR.

Besides being sold in bottles exceeding 10 ml, the vast majority of these concentrated shortfill products have not been tested and many contain TPD banned ingredients, such as diacetyl and acetylpropionyl, as well as containing non-banned flavour ingredients above health criteria values. Now, TPD/TRPR compliant eliquid manufacturers who have had the pricing of their products increase due to the cost of testing, toxicological assessments, MHRA submissions, additional packaging (e.g. peel and reveal labels/boxes and leaflets, multipacks of 10 ml bottles, etc.), are trying to compete in the market place against these cheaper unregulated products that are being produced in unsuitable manufacturing environments and that tend to be more flavourful and more suited to the vaping consumers’ requirements.

TPD/TRPR compliant manufacturers are being forced to supply shortfill products in order to ensure the continuing viability of their businesses. This simply is wrong and must be addressed by regulators immediately to prevent the industry falling back into an unregulated free-for-all situation.

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