A LAB OF ITS TIME

Essentra Scientific Services has evolved from an in-house testing laboratory to a provider of extensive scientific testing services for the global tobacco industry. This evolution was sparked by regulatory requirements facing the industry and also the emergence of a range of new products.

Testing tobacco products for over 50 years

Photos: Essentra plc

It's a late summer's afternoon in Jarrow, a small town built upon the banks of the River Tyne in the north-east of England. It's surprising what can be found in this quiet town located on the verge of the cosmopolitan sprawl of rowdy neighbouring Newcastle: the ruins of a 7th century monastery, which, at the time of its founding, was said to be one of the greatest centres of learning in Europe north of Rome; and, in a high-tech laboratory located in the industrial zone, examples of combustible and next generation tobacco products from around the world, including every cigarette pack available in a certain Pacific island state. The monastery was once home to the monk scholar, the Venerable Bede, who penned seminal works in Latin in the 8th Century and the lab, located off the eponymous Bedesway, belongs to Essentra Scientific Services (ESS), a division of Essentra plc.

Director of Scientific Services, Mike Taylor, welcomes this TJI journalist to the site. He has been with Essentra since the laboratory was relocated to the north of England in 1982 and, later, to its current site in Jarrow in 1998. During Taylor's time at ESS, the lab has gone through a significant transition period. It has evolved from being a modest in-house facility designed to meet the needs of the company's own product development and testing requirements, to being the UK Government's official testing laboratory for tobacco products, accredited to the highest of international standards and busy undertaking a range of scientific testing services for manufacturers around the globe. It's a lab that tells the story of the last half- ▶

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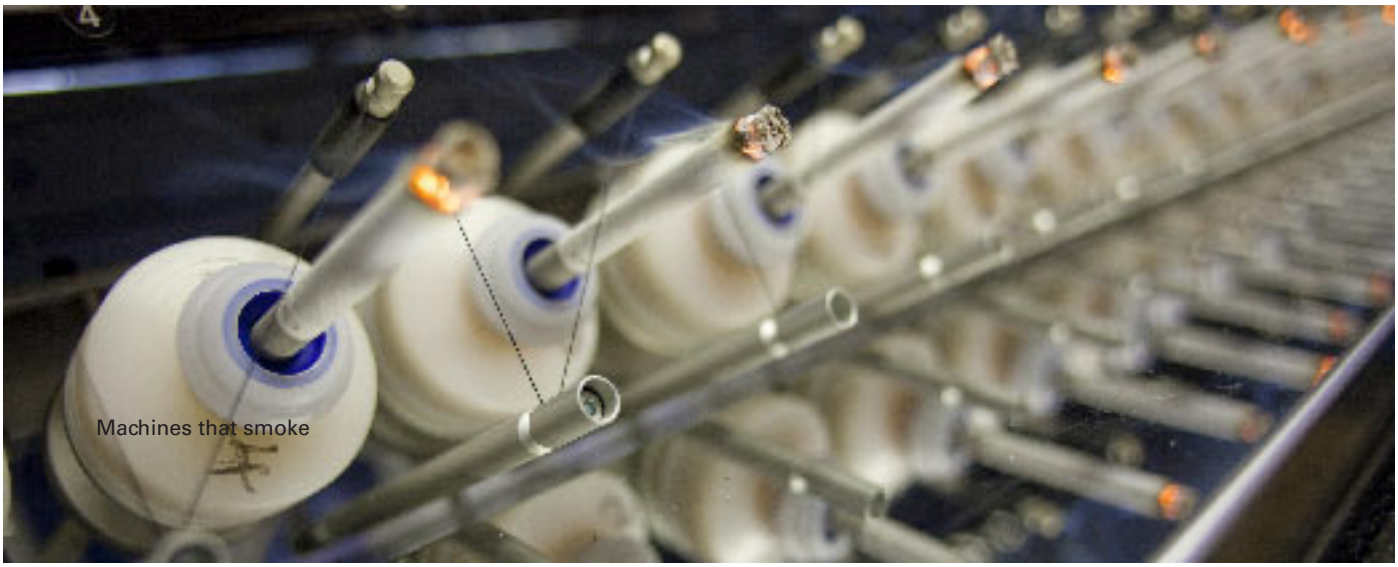

Machines that smoke

century of the tobacco industry and the impacts of the work are felt around the globe. It all began, however, with no commercial aspirations whatsoever.

CAN YOU TEST THIS FOR US?

ESS has been undertaking scientific testing on tobacco products since the 1950s, albeit under a different name. Filtrona, as many of our readers will well know, was re-branded as Essentra in 2013. It was under the name Filtrona that the division of Scientific Services carried out its first laboratory tests. "The company was always focused on testing capabilities," Taylor recalls, "and around 50 years ago, the company was making so many filters that they used to give customers quality control and testing services as an additional service. If a company bought a large volumes of filters from us, we would support them by providing equipment to test them in their factory. For smaller cigarette manufacturers who bought filters from us, if they wanted to send us the three or four brands they were making once a month for quality control tests, we would do it for them and we would also do some method development and product performance [testing] as well." One of the services offered at that time, Taylor explains, was the 'fill test'. This test provided a breakdown of a customer's brand in providing data on the physical parameters of a product, such as length, circumference, weight, pressure drop, draw resistance and paper porosity. In addition, the tar and carbon monoxide yields would be measured as well. However, as demand for testing increased, also from cigarette manufacturers who were not purchasing their filters from Filtrona, the company decided to commercialise its scientific testing activities.

The major milestones that spurred on this commercialisation, Taylor recalls, came with the onset of better recognition of the harmful compounds in tobacco smoke and the introduction of regulation in international markets in testing for these compounds. The majority of the Hoffmann Analytes list, for example, was adopted by the Canadian government in the 1990s and every brand sold in Canada had to be measured for the identified compounds once a year. In the 2000s, Brazil's national department of health, ANVISA, put regulations into place whereby every brand on the Brazilian market had to be licensed with the government. In order to get that license, (as well as paying a considerable fee), each brand had to be tested once per year for around 39 compounds in the mainstream and sidestream smoke and about 20 compounds in the tobacco. "In the beginning," Taylor recalls, "all of the independents in Brazil who were buy-

ESSENTRA SCIENTIFIC SERVICES AT A GLANCE

Accredited test for combustible tobacco products:

- Mainstream for ISO and intense smoking
- Sidestream
- Tobacco testing
- Cigarette filter retention of tar and nicotine
- Ignition propensity
- Physical testing of packs and health warnings
- Testing for testing for weight, pressure drop, paper porosity, draw resistance, ventilation and circumference.

Accredited test for e-cigarettes and vapour products:

- ISO 17025 accredited for the measurement of nicotine, glycerol, propylene glycol, menthol, diethylene glycol, ethylene glycol and water in e-liquids.
- Accredited for the measurement of carbonyls in e-vapour
- Accreditations for the measurement of glycerol, propylene glycol, menthol, diethylene glycol, ethylene glycol and water in e-vapour have been applied for.

ing filters from Filtrona Brazil immediately said 'Well, the government is doing this, so how can we get the products tested?' There were only so many laboratories that were independent of the cigarette manufacturers in the country and who were capable of doing this kind of work. At this point in time, Brazil still accounts for a large percentage of our commercial income in doing this testing for Brazilian independents."

From a laboratory point of view, Taylor says, the mandatory testing for specific compounds was a big step in the transformation of what he refers to as the expansion and accreditation of ESS. "I think accreditation was one of the main things that set us on this path," he remembers, noting that becoming accredited to ISO 17025 standard helped to put the lab on equal footing with the big tobacco manufacturers. "BAT had done it," Taylor recalls, "Rothmans had done it, and so we were the third or fourth to become accredited in the UK. One the one hand it was a matter of keeping up with the neighbours, but if somebody is going to pay to do a test, they are going to pick an accredited lab, so it was also very important for us."

"I think accreditation was one of the main things that set us on this path,"

Mike Tayor

Now fully accredited, expanded and kitted-out with the latest testing equipment, the revised Tobacco Products Directive (TPD2) in Europe and the Food and Drug Administration (FDA) regulations in the US are seeing ESS gear up for an all new generation of testing requirements – and a new generation of tobacco products.

WHAT ABOUT THIS?

ESS has been testing electronic cigarettes commercially for over 6 years. In the commercial life of the e-cig, this is a bit like dog years in comparison to human years. But ▶

e-cigs weren't the first sidestep from the testing of combustible tobacco products and their components for ESS. The lab undertook testing of the first generation of heat-not-burn products well before consumers were ready for them and the ESS has contributed widely to the development of testing standards in the next generation product categories.

"I held a presentation on e-cigarette testing on behalf of ESS at a Coresta conference in 2012," Taylor recalls. "It was the first such presentation ever, and I was the very last man on. They usually divide the sessions into topics, so, of course, I was in the 'odds and sods' right at the end. But, by the time the 2013 Coresta conference came around, we gave another presentation on e-cig testing. The first session on the first morning was dedicated to e-cig testing and we went from being the last man to the very first one up."

From universities to tobacco product manufacturers, testing the emissions of e-cigarettes quickly became a priority for a range of stakeholders from 2010 onward. One of the main challenges in looking at the emissions of e-cigs, however, was deciding what to test for, and how. Taylor explains: "A lot of people said to us, 'We've got an e-cigarette and we want to test it.' And we would say, 'Alright, what would you like done?' and they would say, 'Well, we want to compare it with a cigarette.' So a lot of the first testing was comparative and was done under the ISO cigarette regime. But it quickly became obvious to us that that wasn't the best way to do it." The process of changing the ISO testing elements to cater for vapour products is ongoing, with the Coresta recommended method 81 now with the International Standards Authority. But ESS, an active Coresta member, is already using the recommended method for testing in its own dedicated e-cig laboratory: the requirements of TPD2 and the FDA's deeming regulations mean no shortage of demand.

"We got ourselves ready to test the main components of the liquids," Taylor says. "More recently, there have been the requirements of the TPD2. Requirements to measure the consistency of nicotine and also yield are there, and products should be consistent in terms of use. Then, one of the major measurements for e-cigs in carbonyls. That is mainly formaldehyde, acid aldehyde; these are the compounds which are responsible for this dry, burnt taste. These can be generated by overheating within the device. We went as far as to get the ISO 17025 accreditation for those measurements. Then, TPD2 also asks to measure other compounds, which are metals, some volatile organics, and tobacco-specific nitrosamines for products that feature a tobacco extract, which could be there at very low levels. At the moment, a lot of people are coming to us who are looking to get their products tested by 20 November because that is the deadline for TPD2 submissions," Taylor points out.

Ignition propensity testing

In many ways, ESS's dedicated e-cig lab is currently undergoing the same transition period that the lab for testing combustible tobacco products has already been through: it is now transitioning from mainly doing comparative testing for brand owners to doing more and more routine testing of e-cigs products laid out by enacted legislation.

TOURING THE LABORATORY

The ESS labs are housed within a larger, compartmentalised factory space. They constitute a series of climate-controlled working areas, sealed off from one another and off from the factory space in which they are located.

One of the first rooms we enter is dedicated to physical testing. It's here that the specifications of health warnings are scrutinised. Packs arriving in this space for testing are undergoing significant changes following the introduction of new, larger, and graphic

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health warnings specified by TPD2. Also trickling in for physical testing are the new plain packs which remove manufacturers' branding and colours from cigarette packs sold in the UK. From May 2017, once manufacturers' grace period of one year has elapsed, plain packs will be the only packs seen in Jarrow for UK-specific testing.

In the smoking laboratory, 4 linear, 3 rotary and 1 side stream smoking machine are installed, alongside a range of other machines used to test the drawn smoke. And yet, the smoking lab is completely distinct from the adjacent lab space where e-cigarettes are tested, and this for good reason. E-cigarette testing does not require any new technologies, rather, differences in detection levels and slight differences in how the products and samples need to be handled. In fact, Taylor points out as we tour the facility, capturing the emissions of the product is the same and the technologies are almost identical. "The reason to have a separate lab," he says, "is because of potential cross-contamination."

He shares the following example: "We used to provide filters to a herbal cigarette manufacturer. They came to us one day and said, 'We would like a certificate of analysis from you that our herbal cigarette does not give out any nicotine.' So we said 'Okay, we'll do it on a GCMS because the detection levels are much lower than those we would use for a routine nicotine test.' So we ran the tests with the herbal cigarettes through the GCMS and, much to everybody's surprise, we detected nicotine. It was at very, very low levels. To make a long story short, we repeated the tests again where the holders on the machine were brand new, the flask was brand new, and the equipment we used to transfer the liquid from the flask to the GC vial was brand new… Basically all of the parts of the testing equipment had to be replaced and when we tested it like that we could not detect any nicotine. The nicotine we detected was there through residual use of all of the cigarettes that had been smoked in the machine over the years and the same could be said to tobacco specific nitrosamines and some of the other compounds. Experience has told us that we need to use dedicated machines so that there is no cross-contamination and no residual elements present."

The e-cig testing lab is therefore kitted out with its own dedicated GC with a multiple detector system which allows for the determination of water, nicotine, glycerol, propylene glycol, menthol, diethylene glycol and ethylene glycol, all in one analytical run. Detection levels are typically much lower than in cigarette testing. "If we were going to test for carbonyls, for example, the only difference [between the lab spaces] would be that at the front end in one lab we have a lit cigarette, and in the other lab we have an e-cigarette. In terms of how we do it, how we process the sample, how we run it through the machine, it's all the same. The only difference is that, in order to get meaningful data, you have to have lower levels of detection. This is easy to say, but a little more difficult to do in practice," Taylor points out.

One of the last spaces we visit is a small, dedicated room in the back of the facility where an important test is taking place: ignition propensity. As our readers will know, most governments require that cigarettes sold in their jurisdiction comply with ignition propensity legislation. In short, a lit cigarette – should it fall or be forgotten – must cease burning as quickly as possible and therefore present as little risk as possible of igniting typical surfaces or materials. In order to test this, sticks are lit, placed on sheets of paper and left to burn. The design and manufacture of the sticks should cause them to burn out and lab technicians note the length of the tobacco reduced to ash and other characteristics of the burning stick's impact on the paper sheet. An example of the important work that ESS does, every cigarette for sale on the market of a far-away island state is being put to ignition propensity testing on this day – a process that will likely continue through the week. At the end of the testing, ESS will file the test results and the work that is being done here in Jarrow, in the northeast of England, will continue to have a far-reaching impact.

J.N. Booth