Health Innovation East

INDEXOR SYSTEM

Commissioned by
Health Innovation East

EVALUATION REPORT

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Executive summary

Health Innovation East conducted interviews with four different healthcare sites to gather data and evaluate the effectiveness of the Abbott AlinIQ pre-analytics powered by Indexor in their unique geographical and population settings. All sites interviewed highlighted the efficiency savings gained after the implementation of Indexor as one of its primary benefits. The Indexor system has contributed towards reducing the number of missing samples and improving the overall throughput time for samples.

Another significant outcome after implementation of Indexor has been the environmental sustainability impact on the sample analysis process.

Efficiency savings

500% increase in samples processed per hour was reported in BCPS

65% decrease in processing time was observed in EPA

52% reduction in missing samples was recorded in RCHT

2 hr reduction in throughput time for majority of samples from booking to results were observed in BCPS

Between 10 and 18.2 seconds saved per sample

FTE savings

£121,680 in potential staff cost savings per year.

5 - 6.75 FTEs saved per 10,000 samples were observed in the three sites.

Net zero savings

£1984.63 saved per 100,000 bags used.

1.475 t CO2e saved for every 100,000 bags avoided.

Introduction

The healthcare sector is recognising the need to reduce its environmental impact in the face of global climate challenges. The UK is leading this movement with the aim of being the world's first net zero National Health Service (NHS). The NHS believes that addressing climate change will not only play an environmental role but also bring direct improvements to public health and health equity. Therefore, the Delivering Net Zero NHS agenda [1] has set two ambitious targets:

- For emissions controlled directly by the NHS, the NHS Carbon Footprint, the target is to reach net zero by 2040, with an ambition to reduce 80% by 2028 to 2032.
- For emissions influenced by the NHS, the NHS Carbon Footprint Plus, the target is to reach net zero by 2045, with an ambition to reduce 80% by 2036 to 2039.

To achieve such ambitious targets, organisations like the NHS must look at the whole healthcare ecosystem, work with suppliers who are committed to the same goal and make the adaptation of technologies that aid the net zero agenda at the heart of what they do. The report highlights the requirement of innovation as a key enabler to achieve the ambitious net zero goals.

One system that leverages novel technology to help achieve net zero targets and enhance the efficiency of processing pathology samples is the Indexor sample tube organiser and iRack system. This innovative system provides the opportunity for pathology networks to streamline their operations and at the same time contribute to NHS net zero targets.

Although the processes in core laboratory services are typically highly automated and efficient, the journey of blood samples from the primary care setting to the core laboratory is a perilous one. The Indexor system is designed to address that clinical need by providing information about the journey conditions and making the sample easy to identify, locate, and sort on arrival.

Abbott, a leading healthcare company, has approached Health Innovation East to conduct market research on the Indexor system. Our team has conducted in-depth interviews with four different healthcare sites to gather their data and evaluate the effectiveness of the Indexor system across different settings. Our goal is to gain a comprehensive understanding of how the implementation of the Indexor system has helped these pathology services providers improve their services and, in addition, help the NHS towards their ambitious net zero goals.

About Indexor

The Indexor system [2] is an advanced sample transport tracking system that is highly intuitive and can be expanded across pathology networks. This innovative system is designed to ensure compliance with the highest safety, quality, and traceability standards. The system is equipped with an RFID (Radio Frequency Identification) tag that is placed in the base and connects to the tracking system, thereby creating a fully auditable trail from sample collection to analytical processing.

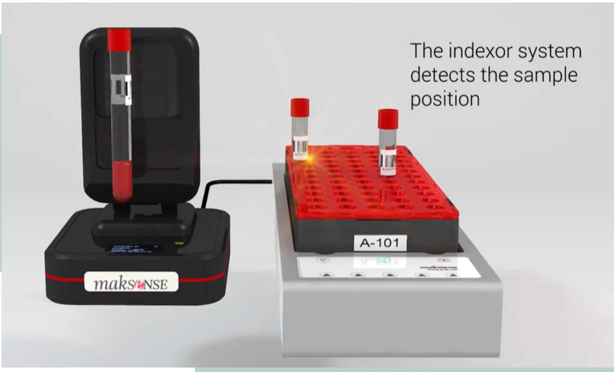

Figure 1: Indexor system detects the sample position

To use the system, a barcode is scanned on the collection tube during the drawing process, then the tube is placed on the rack. The Indexor system will detect the sample position and save all relevant information onto the RFID tag, such as tube identification, tube position, date and time of collection, and collection station.

Upon arrival of a sample at the core laboratory, a sample check-in process is initiated to ensure the integrity and quality of the sample.

This process involves scanning the RFID tag on the sample to retrieve key information such as the date and time of collection, as well as to check for any alerts indicating missing tubes, out-of-range temperatures, or impact damage during transportation.

This critical step is aimed at verifying that the sample has been transported under the appropriate conditions and that it has not been compromised in any way that could affect the accuracy of the test results. By performing a thorough and comprehensive sample check-in, the core laboratory can guarantee that the sample is ready for processing and analysis, thus ensuring the most accurate and reliable results possible.

The Integrated Laboratory System (ILS) in the hospital is used to check-in the data (Figure 2) for all samples in the rack.

Figure 2: Indexor system samples check-in and worklist sorting

This process involves checking in 60 samples simultaneously, and sorting starts immediately, ensuring efficient management of a large number of samples. The sample's position is highlighted with a blinking light. This feature makes it easier to locate the sample and is particularly important when dealing with urgent requests. Samples can also be split into multiple worklists, making it easier to process them more efficiently.

Without the Indexor system installed, samples are collected from sites in plastic bags. Information on transport and handling during their journey to the core laboratory are not collected and therefore increases the potential for lost or mishandled samples. Furthermore, processing of samples at the core laboratory takes longer due to manual booking in and prioritisation.

Indexor Across the UK

Health Innovation East conducted interviews with four distinct sites across the United Kingdom that have implemented the Indexor system. The primary objective was to understand their experiences with the system and identify the principal benefits derived from its use.
Each site occupies a unique geographical position and core laboratory set-up. From our interviews it became clear how each site has different challenges covering dimensions including courier services, operational time and IT integration to wider systems. The study serves as a valuable resource for understanding the real-world implications of implementing the Indexor system in diverse contexts.

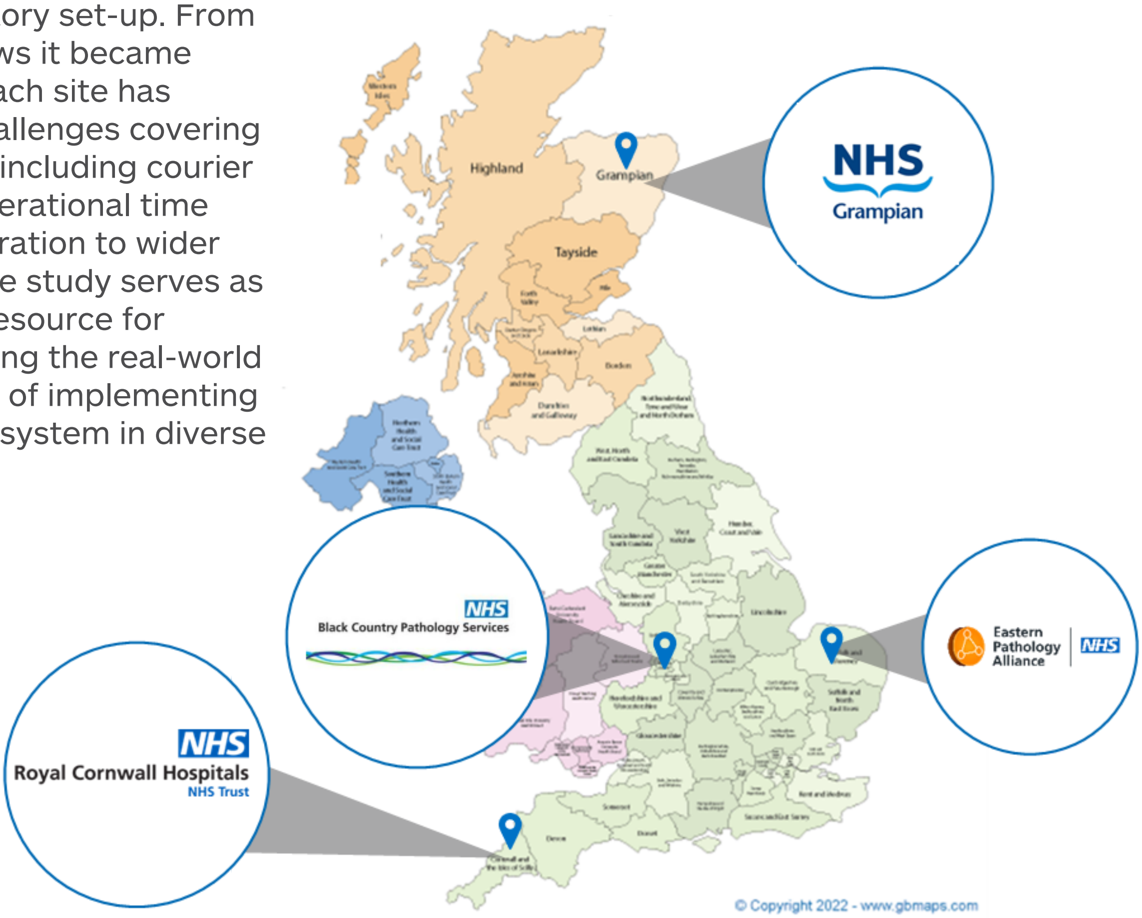

Figure 3: Four sites across the United Kingdom

Royal Cornwall Hospitals NHS Trust (RCHT)

Royal Cornwall Hospital is one laboratory site within the Peninsula Pathology Network. RCHT serves as the leading provider of acute and specialist care services in the counties of Cornwall and Devon, as well as the Isles of Scilly. Its primary mission is to provide high-quality healthcare services to a diverse population of approximately 470,000 people. However, the number of patients can significantly increase during peak tourist seasons due to the influx of visitors to the region.

To meet the healthcare needs of the community, the RCHT operates through three main hospitals, including the Royal Cornwall Hospital in Truro, St. Michael's Hospital in Hayle, and West Cornwall Hospital in Penzance. In addition, it manages nine community hospitals, around 80 GP surgeries, and several mental health and learning disabilities centres across the region.

RCHT is a leading healthcare institution that is at the forefront of medical advancements. They introduced Indexor in 2019, and currently, 95% of all GP work is Indexor bound. The introduction of Indexor was initially driven by the geographical constraints of getting samples from remote areas to the laboratory. Previously, 80% of samples arrived in the late afternoon and had to be manually booked in late into the evening. However, with the help of Indexor, this problem has been effectively resolved, and the system has proven to be highly beneficial for both staff and patients.

Royal Wolverhampton Hospital (BCPS)

Royal Wolverhampton Hospital is the central hub of the Black Country Pathology Services (BCPS) network.

BCPS operates in a hub and spokes pathology service model. As well as Wolverhampton NHS Trust, there are 4 Essential Services Labs (ESL), covering five hospitals and around 400 GP practices within their region. They serve 1.76 million patients, and BCPS has conducted 60 million tests per year [3]. To maintain their levels of efficiency and sustainability, the Royal Wolverhampton Hospital has chosen to use Indexor to help them streamline their processes, improve overall productivity, and reach their sustainability goals.

Currently, Royal Wolverhampton Hospital is in the process of rolling out the first set of Indexor devices across their GP practices. While budgetary constraints have made it difficult to provide all GPs with an Indexor at this time, they are prioritising practices that take more than 20 blood samples per day for this phase of the rollout.

NHS Grampian

NHS Grampian is a prominent regional health board in Scotland, responsible for providing healthcare services to the population of Northeast Scotland. Aberdeen Royal Infirmary is one laboratory site serving the NHS Grampian Health Board, all GP work is sent to Aberdeen Royal Infirmary. NHS Grampian board caters to the needs of around half-a-million people, residing in diverse city, town, village, and rural communities, spread across an extensive area of 3,000 square miles. The organisation operates through a network of 26 primary hospitals, 90 GP practices, and other specialised medical services.

To streamline the sample management process, NHS Grampian has been utilising Indexor since July 2020, it is currently installed across 36 GP practices, covering around 70% of the total samples. Due to geographical constraints, many sample deliveries are made between 4:00 to 7:00 PM.

Prior to using Indexor, the process of manual sample booking was cumbersome, often requiring work to continue late into the night. However, with the implementation of Indexor, the process of sample management has become significantly faster and more efficient, resulting in a reduced chance of human error and lost samples.

Eastern Pathology Alliance (EPA) - Norfolk and Norwich University Hospitals NHS Foundation Trust (NNUH)

The EPA is a managed pathology network that provides Clinical Biochemistry, Immunology, Blood Transfusion, Haematology, Andrology and Microbiology services to primary and secondary care providers across Norfolk and Waveney. Established in 2014, it was one of the first pathology networks in the UK.

NNUH is one of the laboratory sites within EPA network. The hospital itself is a 1,200-bed teaching hospital with state-of-the-art facilities for modern patient care. NNUH runs 3 main hospitals, covers around 100 GP practices and runs more than 60 specialist services as a tertiary centre to provide services to 1 million people within the catchment area.

The EPA NNUH blood sciences hub site is a facility that receives an average of 18,000 specimens per day. The sheer volume of specimens is a challenge when it comes to space capacity and accommodating them would have been impossible without the aid of Indexor. The technology has been utilised since 2019, and it has proven to be an invaluable tool for managing the high volume of specimens. One of the key benefits of the Indexor is the auditable trail that it provides during transport. This feature has been particularly useful for the EPA NNUH blood sciences hub site, as it allows them to track the movement of specimens at every stage of the process.

Indexor Benefits

Efficiency

For the processing laboratories

All sites interviewed have mentioned the efficiency of the Indexor as one of its primary benefits. Booking samples in manually is a slow process that requires more staff and increases the chance of human error. Indexor books those in automatically, simultaneously booking in a 60-sample rack, identifying where all the samples are going and making it easy to find urgent samples. It also allows additional tests to be added to the booking quickly and efficiently without the need to print off additional forms. Once the samples arrive at the lab in an iRack, they are placed in cradles that connect to the LIMS with the help of the primary Indexor IT systems. All the samples are booked in simultaneously, using the data recorded on the chip. The system stores all the information, which eliminates the possibility of human errors and delays. This is particularly valuable as it has been found that 75% of all laboratory errors occur during the pre-laboratory and pre-analytical processes [4].

Indexor has the functionality to track temperature, time and impact data, specific rules can be set up to alert the users if any parameters fall outside of the specified range. Upon receipt, samples can be rejected. This is particularly useful in certain tests that are time-sensitive, as they can be flagged or rejected if they are outside of the specified time frame. Instead of running samples that will not provide an accurate result, the reagents can be saved, and the analyser is freed up to run other samples.

With Indexor, booking staff can be reallocated to perform other important tasks, optimising resource allocation and allowing for upskilling of staff to work on the ward or perform QMS tasks. Additionally, as per the interviews we conducted, it was reported that all sites have seen year-on-year growth of samples; on average, this is 5-10%; however, for some, it is as much as a 30% increase.

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To be able to accommodate this volume would be impossible without the Indexor, simply from a space capacity point of view. The number of PCs/ booking in stations required for this workload, if manually booked in, would require more than double the current number of stations. Since the implementation of the Indexor, the workload has grown by 30% in this section, and the department has managed to function without increasing staffing establishment since implementation due to the Indexor usage.

Blood Sciences Network Manager, EPA- NNUH

Indexor has been a success when used in primary care and feedback from the interview was that some sites are also looking at rolling it out for their hospitals. These hospital units will operate on power packs that are soon to be released .

For the GP practices

After conducting interviews with GP practices, it was reported that the implementation of Indexor has resulted in significant efficiency improvements. In instances where samples need to be transported over greater distances, they can become unstable over time, which means that GP surgeries that are situated further away from processing labs would have to centrifuge the samples before handing them over to couriers. If Indexor is not available, the process of collecting and handling samples becomes more complicated. A request form needs to be printed and filled in by hand, along with labelling the sample tube. With Indexor GPs simply scan barcodes on samples, then place them into the iRack. This logs the date and time samples are taken, as well as other identifiers using the RFID chip in the rack.

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It definitely saves time because before, you had to write on the bottle itself, which is not always possible. You had to write the patient's name, date of birth, and sometimes the NHS number or another identifier. But now you can just stick the label on and scan it. You don't need to write any of that information because you just zap it.

Jane Meachem

Practice Manager, Newquay Health Centre

Once enough samples are collected, the samples need to be taken out of the bag, centrifuged, and put back in the right bag. This process can be time-consuming and may lead to mix-ups between samples. However, practices that use Indexor have eliminated these issues.

In general practices where the Indexor system is not installed, there is a risk of losing or damaging samples during transit. It is estimated that as many as 1 in 1,400 tubes go missing [10]. If such an unfortunate scenario were to occur, a staff member would need to contact the lab to locate the missing sample, which can be a difficult and even impossible task. This process can take up to 45 minutes on the phone and up to three days to obtain the required information. A missing samples would also cause great inconvenience and unnecessary worry for the patient, who would either have to wait for a result for an unreasonable amount of time or worse would require a second bleeding if the sample could not be located.

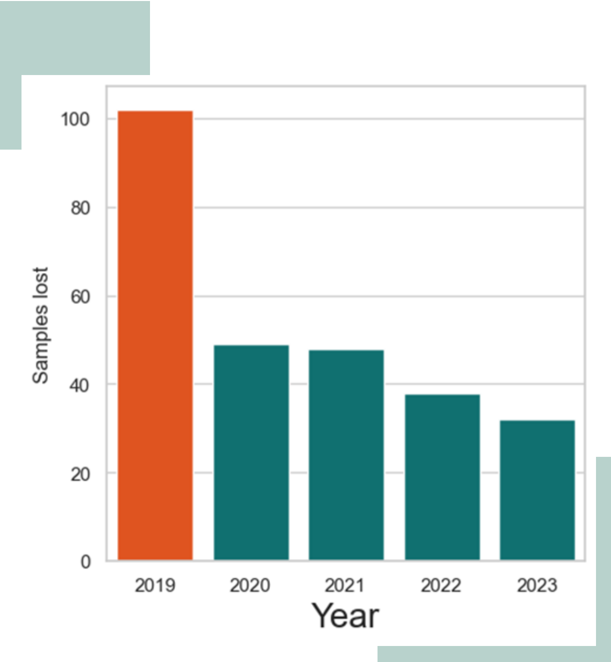

Figure 4: RCHT samples lost data

However, by installing the Indexor system, an auditable trail is created, the necessary pre-work is done, and the laboratories are informed of the expected samples. Just a year after installing the Indexor system in October 2019, RCHT had noticed a 52% reduction in the number of samples that were missing (Figure 4).

The implementation of Indexor has also resulted in a significant reduction in the turnaround time for sample results. In the past, samples could take several days for the results to come back, but now, samples sent with the morning courier can be processed, and the results can be obtained in the afternoon. This is a clear indication of the positive impact of Indexor on the sample turnaround time for GP practices. This will also link in with a better care experience for the patient. Patients can now enjoy shorter waiting times, reducing anxiety and stress, and eliminating the need for re-testing due to lost samples.

Efficiency in numbers

The high number of samples processed at each site (Figure 5) translates to significant time savings, with even a few seconds being saved per test.

Studies conducted in a phlebotomy environment have shown that during a 4–5-minute procedure, phlebotomists spend approximately 4-5% of their time, or 12-14 seconds, performing manual tasks such as placing the collected sample in a single-use plastic bag. However, with the use of the Indexor system, this time was significantly reduced to just 2 seconds per collection as bagging was no longer required [6].

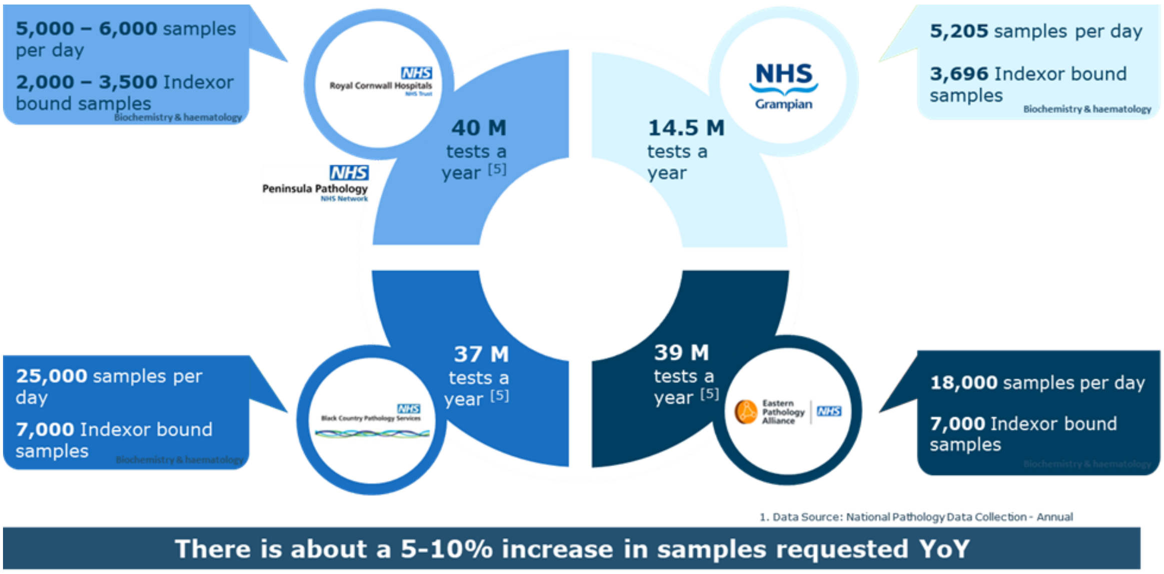

Figure 5: Samples processed daily and annually

RCHT has conducted an analysis of their daily sample processing rates and found a significant increase in numbers. Prior to the installation of Indexor, the average number of samples processed daily stood at 1554 (Figure 6).

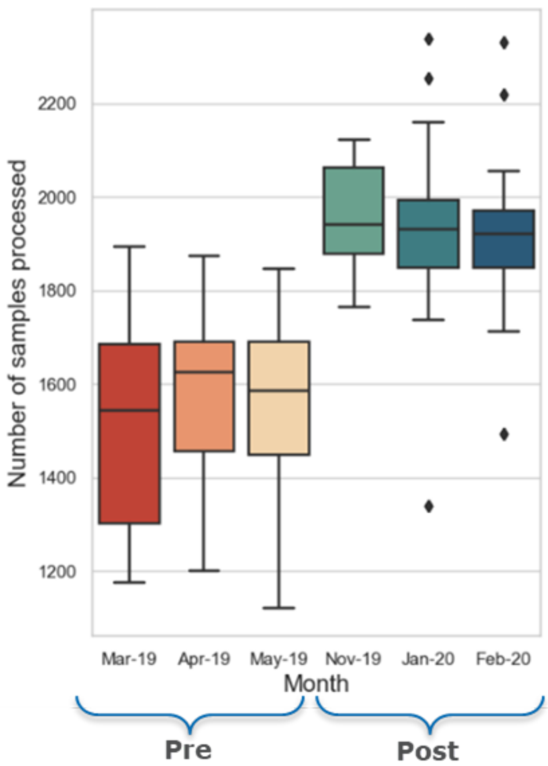

Figure 6: Average number of samples processed pre and post Indexor during core hours

However, after its implementation in October 2019, the average number of samples processed daily jumped to 1937 in November (Figure 6). This represents a 25% increase in samples processed daily and is a testament to the positive impact that modern technology can have on healthcare services. Please note that these numbers represent the samples processed between 9 am and 5:30 pm, which is only a sub-section of the total samples handled in a 24-hour period. However, these numbers reveal an interesting trend and are worth noting.

According to EPA NNUH, registering a sample in their system takes an average of 18.25 seconds. However, by utilising the Indexor system, there is no need to wait for the information to be entered as it is already present in the system, not only saving time but reducing potential for errors. for each request processed. This results in a significant saving of almost 36 hours over 7,000 samples processed daily.

In addition to the time savings, the implementation of the Indexor system also translates into significant financial savings.

For example, based on a Band 3 salary, approximately £121,680 can be saved annually for every 5,000 requests processed. This substantial financial benefit is due to the fact that this system can free up around 5 Full Time Equivalent (FTE) positions, allowing laboratory staff to focus on other tasks or projects (Table 1).

The benefits of the Indexor system are not limited to a single laboratory or site. Other sites have also found similar time savings, with NHS Grampian saving an average of 10 seconds per sample and Royal Cornwall Hospital saving around 14.6 seconds per sample (Appendix 1.3). By adopting this system, laboratories can streamline their processes, reduce waiting times, and provide faster and more efficient services to their clients.

		Time taken per request (s)	Total requests processed daily (#)	Hours per FTE	Total hours	FTE used
EPA	**Pre**	36.5	5,000	7.5	50.69	6.76
	Post	0	5,000	7.5	0	0
	DIFFERENCE					**6.76**
Grampian	**Pre**		5,000		46.88	6.25
	Post		5,000		9.38	1.25
	DIFFERENCE					**5**
RCHT	**Pre**	30	5,000	7.5	41.67	5.56
	Post	0.67	5,000	7.5	0.93	0.12
	DIFFERENCE					**5.43**

Table 1: FTEs saved pre and post Indexor; assuming 7.5 hour working hours (as provided by the sites)

The Indexor system has also proven to be a highly effective solution for BCPS, delivering significant time savings when compared to their previous sample processing methods. To quantify the benefits, BCPS has conducted a thorough analysis of the number of samples processed per person per hour before and after the implementation of the Indexor system. Prior to the adoption of this innovative system, a staff member could process an average of 41 samples per hour. However, with the Indexor system, 60 samples can be simultaneously processed, resulting in a remarkable increase in productivity.

As a result, the same staff member can now process up to 250 samples per hour, representing a phenomenal 500% increase in samples processed per person per hour (Figure 7).

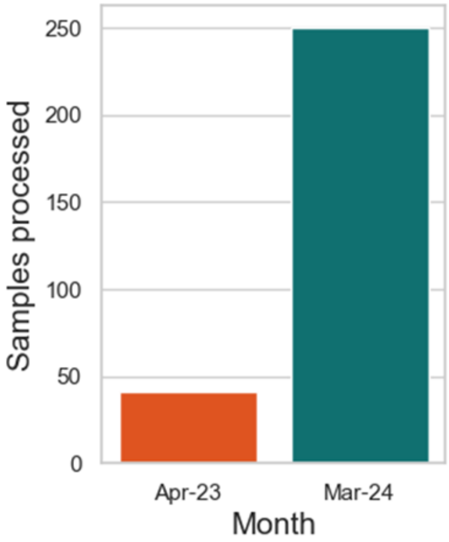

Figure 7: Samples processed per person per hour, pre and post Indexor

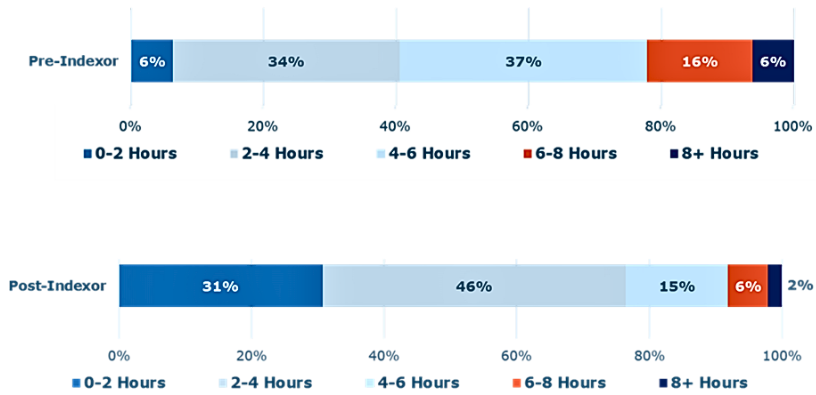

Figure 8: GP samples processed, grouped by hours of sample life since venepuncture

The effectiveness of the system can be gauged by the total duration it takes to process a sample from the point of venepuncture to the final results. With the implementation of the new system, there has been a noticeable improvement in the throughput time. Previously, only 6% of samples could be processed within 2 hours of venepuncture. However, this figure has significantly increased to 31% with the new system in place. Similarly, approximately 40% of samples could be processed within 4 hours of venepuncture in the past, whereas the current rate of processing within the same time frame stands at an impressive 77% (Figure 8). This indicates a substantial increase in efficiency and productivity, resulting in faster and more accurate analysis of samples.

Net zero benefits

Environmental sustainability is a critical driver for the NHS in all aspects of healthcare provision. It is crucial for individuals and organisations to adopt measures to minimise their carbon footprint. In the field of pathology services, reducing plastic waste generated by specimen bags can make a significant contribution to this cause.

Currently, plastic bags such as Midco's Easy Open MPPB8058 are used for specimen transportation and storage in pathology services. These bags are manufactured and shipped from distant locations like China, resulting in a substantial carbon footprint. For every 100,000 bags used, 390kg of plastic is produced, accompanied by significant carbon emissions. The carbon footprint created by these bags is multifaceted, starting from the procurement of goods and services to the distribution and clinical waste incineration process.

The impact on the environment is significant, and the NHS could save up to 1.475t CO2e for every 100,000 bags avoided, as well substantial financial savings (Appendix 3.1).

The Indexor system offers a promising solution that can provide both environmental and financial benefits. This system replaces traditional plastic bags with reusable specimen racks that are more durable and long-lasting. It is a disruptive innovation in the pathology services industry as not only helps in reducing plastic waste but also offers cost savings compared to services using traditional collection methods in plastic bags.

By eliminating the need for single-use plastic bags, organisations can save on procurement costs and reduce their carbon footprint.

The Indexor system presents a unique opportunity for healthcare providers to not only reduce their environmental impact but also save money by reducing the plastic bags that needs to be purchased. The potential savings associated with the use of Indexor are significant, with NHS providers alone potentially saving up to £1,744 in direct costs for 100,000 bags. Furthermore, there is a savings of £240.63 per 100,000 bags due to high temperature incineration (HTI) cost [7], bringing the real savings to £1,984.63.

	Weight plastic bags	CO2 emission	Potential savings
NHS Royal Cornwall Hospitals NHS Trust	2,535 Kg	9.59 t	£12,900
NHS Grampian	2,844 Kg	10.76 t	£14,473
Eastern Pathology Alliance NHS	3,549 Kg	13.42 t	£18,060
NHS Black Country Pathology Services	9,508 Kg	35.96 t	£48,389

Table 2: Potential savings in kilograms, CO2 emissions and Pounds

Our conversations with the four sites have highlighted the weight of plastic bags, carbon emissions, and cost savings. The potential savings for those sites are demonstrated in Table 2 based on the daily plastic bag usage provided by each site.

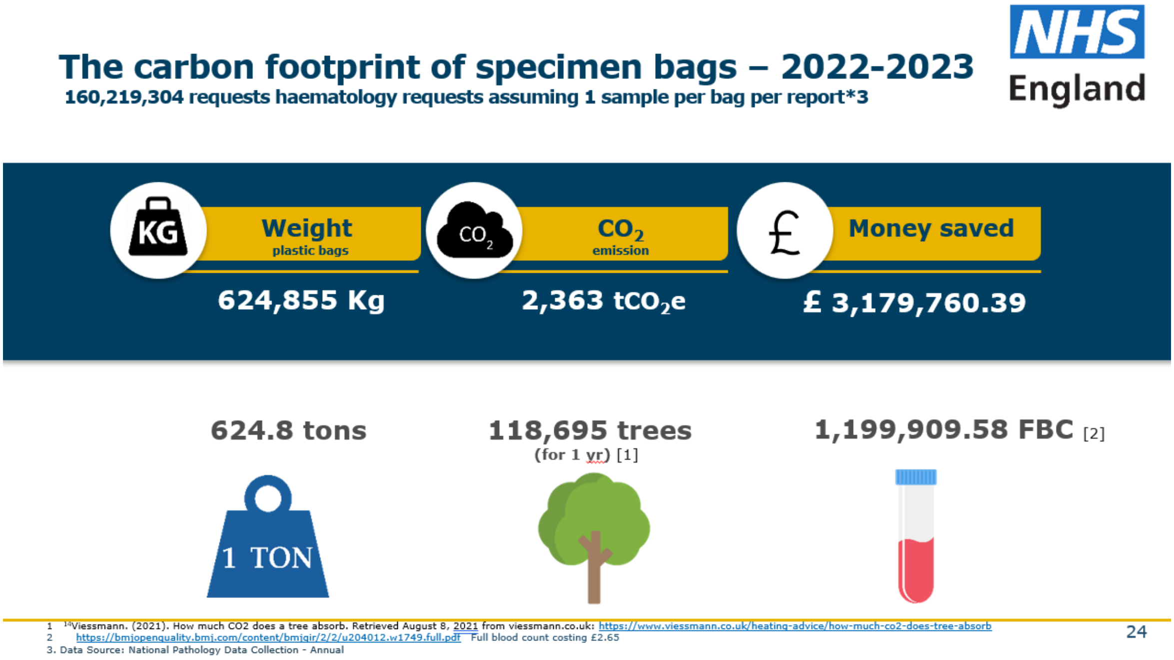

Figure 9: Carbon footprint of specimen bags for the NHS England and the potential impact

During the period of 2022-2023, the National Health Service (NHS) has received over 160 million blood sciences total requests [5], with each request typically contained in one plastic bag. Blood sciences would constitute requests from Chemistry, Haematology and Immunology departments. Considering the current rate of plastic usage, the NHS could potentially save around 624.9 tons of plastic by using Indexor (Figure 10). This reduction in plastic usage could also contribute towards a significant reduction of CO2 emissions by 2,363.2 tons, which would play a crucial role in helping the environment. Furthermore, reducing plastic usage could result in a considerable amount of monetary savings, with an estimated value of approximately £3,179,760. Hence, reducing the usage of plastic in the haematology department could have a positive impact in more ways than one.

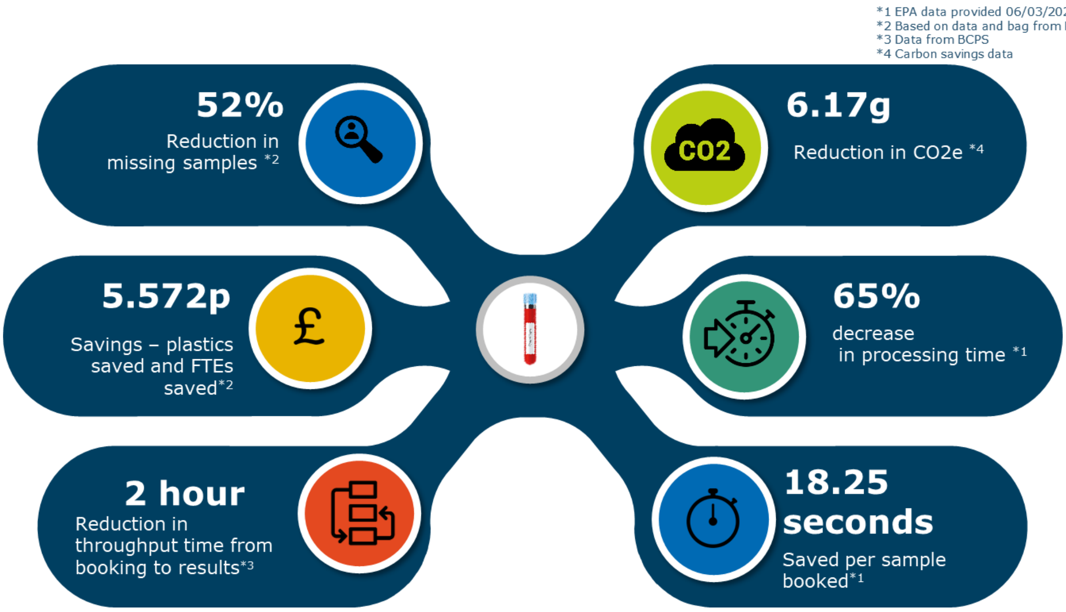

Figure 10: The overall impact of Indexor on a blood sample

The Indexor system has proved to be highly beneficial for the sample analysis process, as it has a multifaceted impact on the samples. Figure 10 shows the impact of Indexor on a blood sample as it journeys through booking and processing in pathology networks. The figure demonstrates that it has contributed significantly towards reducing the number of missing samples. Not only that, but it has also resulted in a significant improvement in the overall throughput time, as samples can now be processed more quickly and efficiently. Furthermore, the Indexor system has played a crucial role in minimising the environmental impact of the sample analysis process. It has led to a decrease in CO2 emissions and single plastic use, which is a significant step towards creating an eco-friendly workplace. Overall, these positive impacts of the Indexor system have resulted in making the sample analysis process more efficient, accurate, and environmentally friendly.

Further use-cases

Through our research, we have identified areas where the implementation of Indexor can further enhance patient outcomes, process improvements and sustainability goals.

The use of Unmanned Aerial Vehicles (UAV)s in Cornwall

The Open Skies Cornwall project focuses on leveraging UAVs (Unmanned Aerial Vehicles) to tackle logistical hurdles in transporting pathology samples, blood products, and pharmacy services across Cornwall. The region grapples with challenges like inadequate road infrastructure, high road traffic, and weather-related disruptions, particularly for off-island communities like the Isles of Scilly. Consequently, about 90 days of transport are lost annually due to weather or unavailability of transportation.

The project aims to achieve several outcomes, including establishing a reliable and robust transport system, reducing transport timeframes, and improving the Turnaround Time (TAT) for sample receipt and results. Additionally, there's a focus on reducing carbon emissions by minimising Pathology van journeys and supporting time-sensitive sampling. Contingency transport processes are also being established to ensure uninterrupted service provision, especially between Royal Cornwall Hospital and University Hospital Plymouth.

Specific solutions proposed include establishing a direct transport route from the Isles of Scilly to mainland Cornwall, enhancing the delivery service between healthcare facilities, and implementing a hub-and-spoke route for geographically remote surgeries. The latter aims to increase courier collection availability and improve TAT for sample receipt and results.

In this endeavour, the integration of the Indexor pre-analytics system plays a crucial role. The Indexor system offers a plastic-free sample transport solution, reducing plastic waste by 2.5 tonnes annually.

It ensures reliable transport, decreases timeframes, and supports time-sensitive sampling. Moreover, it provides auditability of sample integrity (temperature/impact) and automates sample receipt into Laboratory Information Management Systems (LIMS).

Furthermore, the project aligns with broader environmental goals by seeking to reduce carbon emissions. By opting for sustainable UAV solutions and integrating the Indexor system, the project contributes to a greener tomorrow while enhancing healthcare service delivery throughout Cornwall. This creative Open Skies project could provide an excellent blueprint for other rural areas adopting UAVs and Indexor.

Full Pathway Rollout

The Indexor system ensures secure and efficient transport of blood samples from hospitals and primary care facilities, maintaining sample integrity and environmental sustainability. Pathology services sites in this report that have implemented Indexor are reporting the rollout to other services including acute and outpatient facilities.

Acknowledgements

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Net Zero validation by Eco Sourcing Hub

We have partnered with Eco Sourcing Hub https://ecosourcinghub.co.uk/ a sustainability & procurement consultancy, dedicated to providing innovative and effective solutions for supply chain management, sourcing and carbon footprint management to validate our findings related to CO_2e emissions savings.

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Appendix

1. RCHT

1.1 Missing samples data:

2019	2020	2021	2022	2023
102	49	48	38	32

1.2 Samples delivered to p540 (pre analytical solution) pre and post Indexor.

PRE			POST		
Mar-19	Apr-19	May-19	Nov-19	Jan-19	Feb-19
1174	1454	1846	1936	1340	1492
1304	1683	1784	1936	1911	2056
1733	1678	1454	2123	1738	1950
1778	1458	1121	1983	1744	1986
1894	1666	1683	2062	1925	2037
1263	1500	1710	1944	2255	1922
1492	1667	1642	1887	1822	1811
1494	1452	1363	1855	1939	1966
1800	1200	1355	2063	1986	2331

1490	1600	1555	1785	1940	1922
1545	1237	1478	1990	2339	1942
1300	1648	1801	1844	2079	1909
1688	1752	1434	2087	1850	1842
1587	1776	1520	1763	1848	1931
1254	1324	1616	2088	1914	1892
1602	1772	1766	1848	2010	1850
1280	1507	1272	1912	1936	1826
1542	1874	1680	1900	1946	1906
1682	1501	1661	2047	1922	1712
1673	1709	1499	2080	2160	2218
1382				1628	
				1640	

1.3 individual request processing time

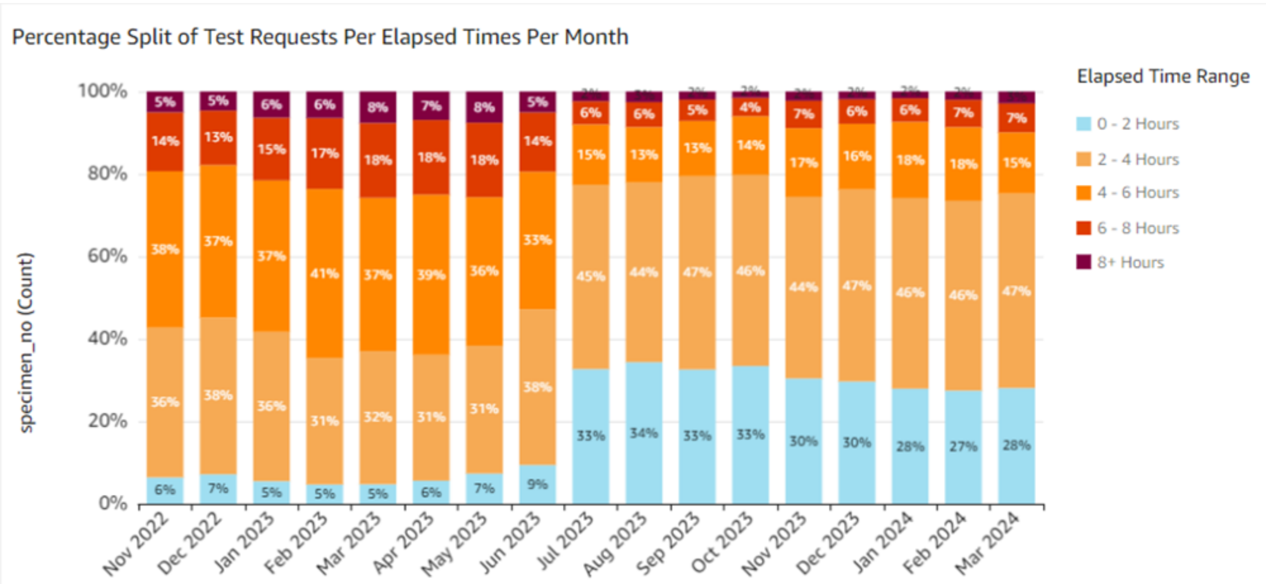
	SAMPLES	Total samples processed (s)	per sample time (s)
Pre	60	900	15
Post	60	20	0.4

2. BCPS

2.1 Samples processed per person

Month	Samples processed per person
Apr-23	41
Mar-24	250

2.2 GP samples, grouped by hours of sample life since venepuncture (Indexor start July 23)



	0-2 Hours	2-4 Hours	4-6 Hours	6-8 Hours	8+ Hours
Nov-22	6%	36%	38%	14%	5%
Dec-22	7%	38%	37%	13%	5%
Jan-23	5%	36%	37%	15%	6%
Feb-23	5%	31%	41%	17%	6%
Mar-23	5%	32%	37%	18%	8%
Apr-23	6%	31%	39%	18%	7%

May -23	7%	31%	36%	18%	8%
Jun-23	9%	38%	33%	14%	5%
Jul-23	33%	45%	15%	6%	1%
Aug-23	34%	44%	13%	6%	3%
Sep-23	33%	47%	13%	5%	2%
Oct-23	33%	46%	14%	4%	3%
Nov-23	30%	44%	17%	7%	2%
Dec-23	30%	47%	16%	6%	1%

Jan-24	28%	46%	18%	6%	2%
Feb-24	27%	46%	18%	7%	2%
Mar-24	28%	47%	15%	7%	3%

3. NHS Net zero data

3.1 Eco-sourcing hub report for 100,000 plastic bags

The aim of this report is to illustrate the potential reduction in greenhouse gas emissions achievable by abstaining from the procurement of LDPE bags. The study employs a unit of measure of 100,000 bags to assess the impact. The analysis encompasses the entire lifecycle, including the carbon footprint associated with sourcing these bags from China, their transportation to the hospital, and the subsequent recycling process. The emissions are categorized as follows:

1. Goods & Services - Embedded emissions in the purchase of these bags, cradle to gate.
2. Transport Upstream - Emissions related to the transportation of the bags from China to the supplier by sea and to the hospital by average van delivery.
3. Waste - Emissions related to the disposal of these bags.

Methodologies for the Collection and Quantification of Data

The emissions summary reflects the consolidation of emissions data according to the Greenhouse Gas Protocol reporting standards. These being the Corporate Accounting and Reporting Standard (2004) and the Corporate Value Chain Accounting and Reporting Standard (2011).

The emissions summary also reflects the consolidation of emissions data according to the ISO 140641-1:2018 Standard.

Approach to Emission Factors

The most relevant and localised emission factor possible has been selected. A full list of emission factor publications used in this report can be found in the table below:

Publisher	Publication Version	Publication Date	URL
ecoinvent	3.9.1	01/12/2022	link
UK.gov	v2023 1.0	15/05/2023	link
Library of emission factors for specific use NHS Report	Version 1,	31 January 2023	link

Each emission factor used in the calculation has an assigned validity period overlapping or partially overlapping with the application period of the reported activity. The validity period of emission factors is determined by its publication document.

100,000 Average weight of a bag: 100 packs of bags weigh 0.390 kg total 0.0039 x 100,000 = 390 kg

Consolidated Statement of GHG Emissions

	Emission Category	Scope	All GHG (*tCO_2e*)
3	Scope 3 - Indirect Emissions in the value chain - Upstream		1
3.1	Purchased goods and services	Scope 3	1.009
3.4	Upstream transportation and distribution	Scope 3	0.217
3.5	Waste generated in operations	Scope 3	0.2496
		Total	1.475 tCO2e

The findings suggest that by refraining from using these bags, NHS providers can potentially save up to **<u>1,475 kilograms of CO2e (1.475 tCo2e)</u>** for every **<u>100,000 bags</u>** avoided. This encompasses the reduction in CO2 emissions associated with avoiding the raw material production of LDPE, transportation, and the recycling process following their use, all of which are connected to these bags.

SK 21/3/2024

Dataset Identification

Activity Name	polyethylene production, low density, granulate
Geography	Rest-of-World
Reference Product	polyethylene, low density, granulate
Synonyms	LDPE
Geography (abb.)	RoW
Time period start	2011-01-01
Time period end	2022-12-31
Valid entire time period	True
ISIC rev.4 ecoinvent	2013: Manufacture of plastics and synthetic rubber in primary forms
CPC classification	34710: Polymers of ethylene, in primary forms
Technology level	3
Ecoinvent version	3.9.1

Dataset Authorship and source

Data generator	Thomas Fröhlich
Data generator contact	thomas.froehlich@ifeu.de
Data entry	Thomas Froehlich
Published source First Author	PlasticsEurope
Published source Year	2016

Exchange summary

Reference product

Reference product	By-product classification	Amount	Unit
polyethylene, low density, granulate	allocatable product	1	kg

Properties Property

Name	Comment	Amount	Unit
Allocation Factor	-	0.99813	dimensionless
Carbon Allocation	-	0.85714	kg
Carbon Content	-	0.85714	dimensionless
Carbon Content, Fossil	-	0.85714	dimensionless
Carbon Content, Non-Fossil	-	0.00000	dimensionless
Dry Mass	-	1.00000	kg
Heating Value, Net	See below	42.47000	MJ
Price	See below	1.29000	EUR2005
True Value	-	1.29000	dimensionless
Water Content	-	0.00000	dimensionless
Water In Wet Mass	-	0.00000	kg
Wet Mass	-	1.00000	kg

Impact Assessment Results

Method	Category	Indicator	Value	Unit
IPCC 2021 no LT	climate change:	global warming potential	2.50110	kg CO_2-eq fossil no LT (GWP100) no LT

Detailed Information Reference product

Production volume unit: kg
Production volume amount: 26747368421.0526
Production mathematical relation: -
Production volume comment: According to Plastics Europe, Global production volume of plastics in 2013 was 299 Mt. It is assumed that the global production share (of the total plastic production) of polyethylene, low density, granulate is equal to the respective European production share, which is 14 % of the total plastics production in Europe. Source: PlasticsEurope, 2013, Plastics - The Facts 2013, accessed online at: https://www.plasticseurope.org/en/resources/market-data on 11th of July 2018

Dataset Comments

General Comment

The dataset represents the production mix of commercial LDPE production technologies: high pressure polymerisation using oxygen and/or organic peroxides as initiator

LDPE is produced through high-pressure polymerisation. As typical initiators to start the polymerisation process, organic peroxides and oxygen are used. Furthermore, polar modifiers (aldehydes, ketones, or alcohols) or aliphatic hydrocarbons are fed into the monomer stream to control the molecular weight distribution.

High-pressure polymerisation is carried out at pressures of 1500 to 3500 bar and temperatures of about 200°C. Under those conditions, oxygen or peroxides work as initiators to start the radical polymerisation process. The reaction may take place either in an autoclave or a tubular reactor. The polymerisation is an exothermic reaction. The ethylene gas is used as a heat sink for the resulting heat, which means that the ethylene gas cannot be to-tally converted to polymer. The unreacted gas is directly recycled back into the process and combined with fresh ethylene. Furthermore, the heat of the exothermic reaction can be recuperated to generate low pressure steam.

The initiator concentrations usually vary between 0.1 and 0.5 wt.-%. Decomposed metal alkyl residues of the initiator remain in the product and sometimes have an influence on end-use properties. Dissociation products of the radical initiator are removed from the polymer or built in.

After the reaction phase, most of the residual (unreacted) monomers (which are mostly present as gases) are separated from the polymer and are either recycled back into the process or flared of. Depending on the purity of the separated monomers, the gas can either be fed directly back into the production line or the monomers are returned to a purification unit. To limit the accumulation of impurities in the process, usually a small side-stream (purge) of the unreacted gas is sent back to the cracker or to a dedicated purification unit. After polymerisation, the polymer is usually fed di-rectly into a hot melt extruder, where additives can be added to the melted polymer if required. The polymer is then pelletised in an underwater pelletiser. The pelletised product is dried, blended where required and degassed.

Included activities start

Acitivity starts with monomers and comonomers entering the polymerisation plant. Energy supply is included in terms of heat production inside the battery limits of the plant. Steam and electricity supply is outside the activity. From cradle, i.e. including all upstream activities.

Included activities end

Activity ends with polymer granulate leaving the factory.

Sampling procedure

Extrapolated from European data. Questionnaires sent out to all production units in Europe operated by PlasticEurope member companies.

Extrapolations

This dataset has been created as a copy of the original dataset covering the geography RER, i.e., Europe. Annual production volume(s) and uncertainty have been adjusted accordingly. It is important to note that original RER dataset represents the average production mix, composed of several different processes/technologies, in Europe in the year of reference. It might not reflect the actual global production mix and should hence only be used as a proxy.

Technology comment

Geography comment

Extrapolated from dataset with data for EU27 including Norway and Switzerland. The production volume and uncertainty have been adjusted accordingly.

Time period comment

Data was collected for the year 2011, processed in 2013 and published in 2014

Properties comment

Heating Value, Net

Assumed equal to "waste polyethylene".

Price