



Johnson Matthey

40 YEARS

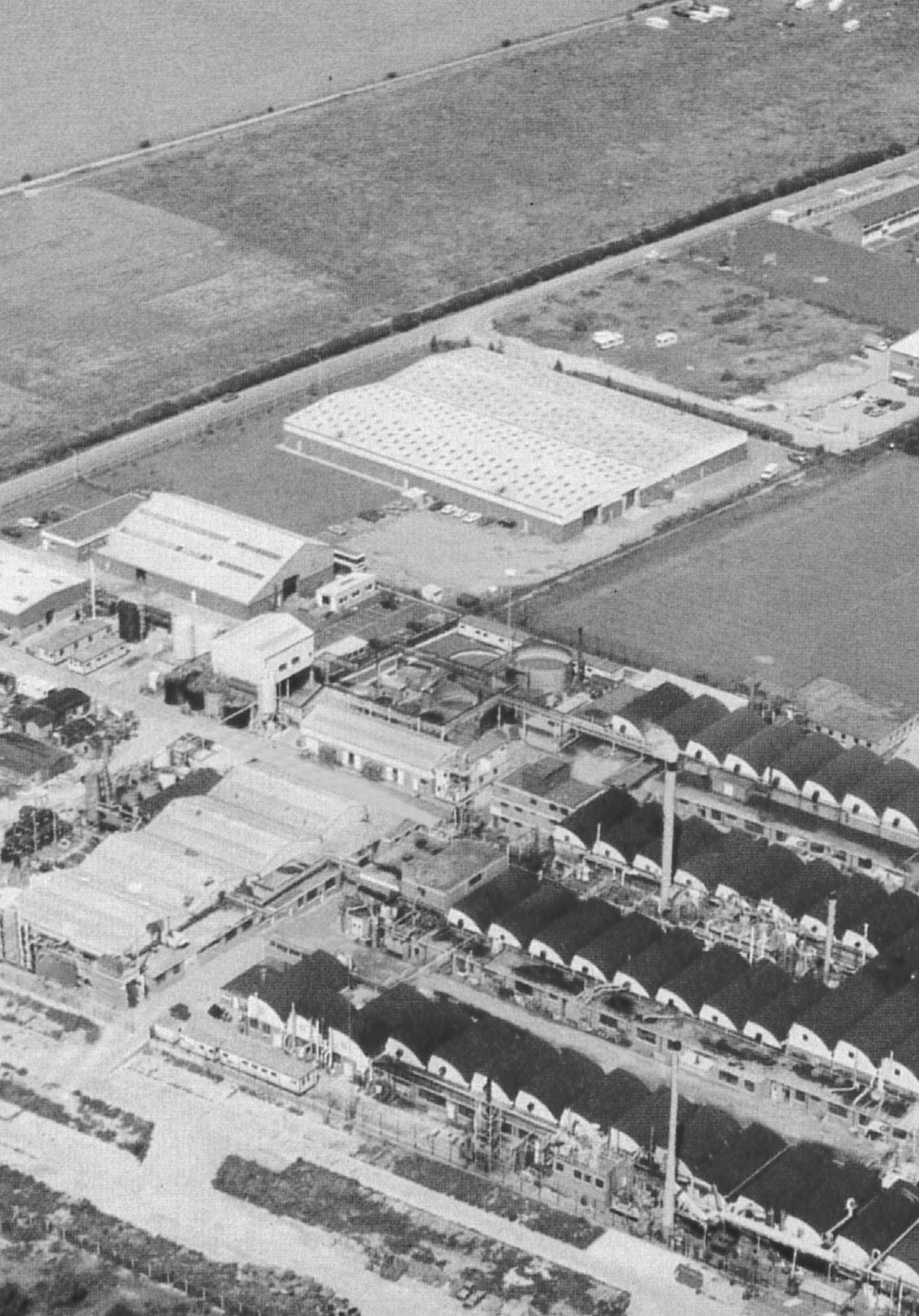
OF CLEANER AIR

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Johnson Matthey is a pioneer in the field of emissions control having made its first autocatalyst in Royston in May 1974. Through constant investment in research and development our emission control products have evolved over time to encompass different fuels and vehicles. From humble beginnings in Royston, we have become a world leader in emissions control. This booklet highlights our milestones over the past 40 years.



Pollution drives legislation

In 2014, one out of every three cars in the world is fitted with a Johnson Matthey autocatalyst, which removes over 99% of the engine's dangerous emissions. This means the gases that leave your vehicle are virtually as clean as the air that enters and many millions of tonnes of pollutants are prevented from entering the atmosphere.

But in the 1940s it was a very different story. Large cities, particularly in America, were beginning to experience increasingly dangerous levels of air pollution. It wasn't long before scientists, particularly Dr Arie Haagen-Smit at the California Institute of Technology, pointed the finger of blame firmly in the direction of the internal combustion engine.

"Initial markets for our catalyst technology in the late 1960s included emissions control from factories, as well as reducing the odour from electric combusting toilets in Sweden!"

Rob Searles, Market Development Director (1967–1996)

In 1965, America's Motor Vehicle Air Pollution Control Act set the world's first emissions standards for cars. From then on, the global motor industry would come under increasing pressure to clean up its act. In 1969 Johnson Matthey switched its research focus from catalysts for the chemical manufacturing industry to the development of commercially viable catalysts for petrol engines. The rest, as they say, is history...

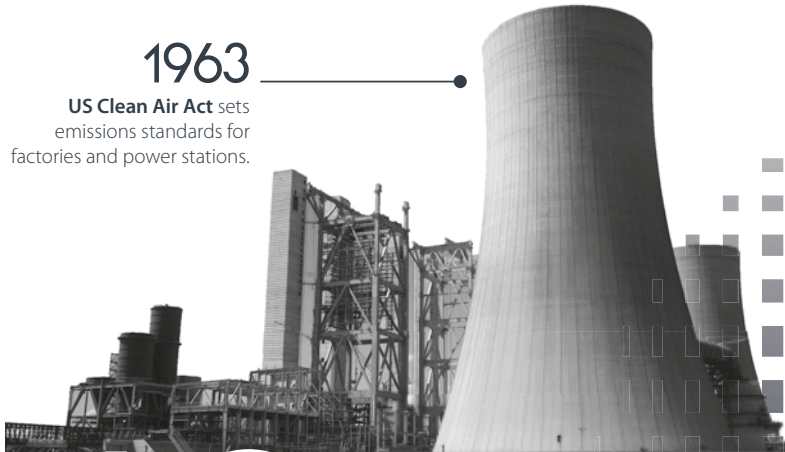
1940s

Larger cities worldwide begin to experience man-made pollution.



1963

US Clean Air Act sets emissions standards for factories and power stations.



40-60s

1950s

California Institute of Technology proves exhaust emissions are major cause of LA smog.

1956

UK government passes the Clean Air Act in response to London's Great Smog of 1952.



1968

All new cars in US must meet the regulations. This was initially achieved through better engine tuning.



1969

We begin Research and Development into autocatalyst technology at research laboratories at Wembley, West London and at new catalyst development facilities in Royston.

Invention & innovation

In 1971, just two years after formal research and development work began at our Wembley labs, Johnson Matthey filed its patent for a rhodium-promoted catalyst. This was a 'two way' device, designed to remove carbon monoxide and hydrocarbons created by incomplete combustion of the petrol.

"The waterfall process used to apply washcoat to substrates until 2000 was first tested in the lab using a baby bath, a bucket and two wooden slats."

Dennis Webster, Technology Director (1963–1996)

The catalysts were constructed by coating the inner surfaces of a block of ceramic honeycomb material with alumina and precious metals – initially rhodium and platinum. The heat-resistant honeycomb material was invented by Corning in 1972.

The automotive industry was initially sceptical about the durability of autocatalysts, and focussed on engineering solutions. Johnson Matthey demonstrated that a catalyst remained active after 26,500 miles of driving on a Chrysler Avenger which was a critical step in persuading the US authorities that the technology was viable.



DID YOU KNOW?

The surface area of a bare substrate increases to the size of three full-sized football pitches when coated with the catalyst.

"An early proving run was carried out during the 3 day week. Manufacturing was prioritised whenever the power was on, then we huddled around candles working up the production data."

Dennis Webster, Technology Director (1963–1996)

In late 1973, the Johnson Matthey production plant opened in Royston, with 200 people in R&D, production and sales. And by May 1974, the first mass-produced autocatalysts were on their way to Volkswagen, to be used on their US export cars. Our first US production plant in Wayne, Pennsylvania, opened later that year.

1970

US Clean Air Amendments Act requires emissions to be reduced by another **90%** by 1975. To meet this requirement, catalysts were fitted to vehicles.

Johnson Matthey installs its first manufacturing facilities in Royston. A second, based on the Royston model, is built in Wayne, Pennsylvania to supply the US car market.

1974

1975

New Headquarters offices built in Royston.
First cars fitted with oxidation catalysts
hit **US** showrooms.

70s

JOHNSON MATTHEY
THE WORLD'S FIRST CATALYSTS
TO CONTROL VEHICLE
POLLUTION WERE PRODUCED
IN THIS BUILDING
IN MAY 1974

We supply the world's first mass-produced catalytic converters to Volkswagen – 1974

1M

1979

Royston produced over **750,000** catalysts during the 1970s.

1977

We receive our first Queen's Award for Technological Achievement for the development of platinum-rhodium catalysts.

1972

Corning demonstrates ceramic honeycomb material that can support our high temperature catalyst process.

We show the US Environmental Protection Agency that emissions targets can be met with our catalysts.

1971

We file patent for rhodium-promoted platinum catalyst.

Two way becomes three way

?

DID YOU KNOW?

One out of every three catalysts in new cars worldwide is made by Johnson Matthey.

NO_x limits were tightened in the US from 1976, and were originally met by running the engine rich and reducing NO_x over an additional catalyst. However, this was detrimental to fuel economy and a new solution was needed.

"Prince Philip drove himself to Royston in a Range Rover on his way back from a visit to Cambridge."

Dennis Webster, Technology Director (1963–1996)
(See picture with Prince Philip, 1981)

Johnson Matthey scientists responded to the new challenge by developing the three way catalyst (TWC). By carefully controlling the engine's air/fuel mixture, with the help of fuel injectors and oxygen sensors in the exhaust, the catalyst could convert NO_x to harmless nitrogen, at the same time as removing carbon monoxide and hydrocarbons.

The TWC was factory-fitted to the majority of American-made cars by 1982, and was effectively adopted as the global standard for autocatalyst technology in petrol cars.

"There was a sea change in the company's attitude towards customers. With autocatalysts we had to work closely with customers to understand and meet their needs."

Tony Wilkins, Systems & Applications Manager: Technology (1962–2001)

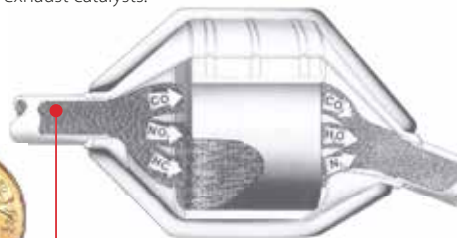
1980

The Johnson Matthey Technology team wins prestigious **MacRobert Award** for engineering for their outstanding work in the development of catalyst systems for controlling vehicle exhaust emissions.



1983

UK government commits to introducing unleaded petrol by 1990. Unleaded petrol was an important requirement for the use of exhaust catalysts.



1984

VW Scirocco trial shows that our three way catalysts meet California standards after 50,000 miles at 107 mph.



1987

The Royston Production Team.



80s

1981

Three way catalysts introduced to meet new US emissions standards.

Prince Philip reviews the latest technology at the Royston facility with Dennis Webster.



1985

Johnson Matthey receives recognition for supplying the one millionth catalyst to Volkswagen.

Johnson Matthey forms an international Catalytic Systems Division (CSD) recognising the worldwide potential of the autocatalyst business. Later on, the division became known as Emission Control Technologies (ECT).

Catalysts for diesel engines

Diesel oxidation catalysts (DOCs) appeared in the marketplace in 1990. The diesel car offered reliability, longevity and fuel economy and vehicles sales increased during the early 1990s. With the aid of a catalyst, the diesel car became as environmentally sound as a fully catalysed petrol car. In preparation for the introduction of Euro 2 emissions standards Johnson Matthey extended its facilities in Royston to manufacture catalysts for diesel engines.

This was followed, in 1995, by the launch of our award-winning Continuously Regenerating Trap system (CRT®), a device which once retrofitted to heavy duty diesel vehicles, such as lorries and buses, greatly reduces emissions. Today Johnson Matthey's CRT® system is the world's most widely used retrofit technology.



DID YOU KNOW?

Thanks to the help of exhaust catalyst technology, it would take a fleet of around 50 modern cars to give the same level of tailpipe pollutants per mile as one typical car from the 1970s.

"We used to demonstrate how effective the CRT® was by putting a white hankie over the exhaust. A thick sooty mark was left by standard buses and vans; with the filter it stayed clean. We did this on Tomorrow's World with Carol Vorderman too!"

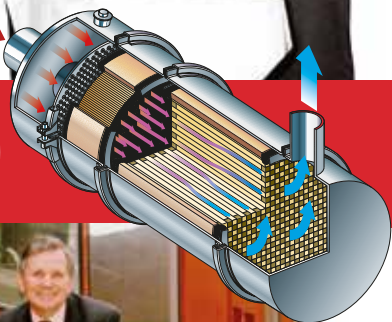
Rob Searles, Market Development Director (1967–1996)

(See picture below from 1995)

As the existing emissions regulations in Europe became more stringent, especially in relation to particulate matter (PM) – tiny, breathable pollutants which upon entering the atmosphere and can cause health problems – Johnson Matthey's scientists and engineers faced a new challenge: to produce effective and affordable particulate filters for diesel passenger cars, which would greatly reduce the amount of PM.

1990

VW Golf is **world's first** diesel car with factory-fitted oxidation catalyst.



90s

6M

1992

Catalytic Systems Division (CSD) celebrates supplying its 15 millionth catalyst to the European market, 6 million of which were made in Royston.



1993

CSD wins two **Queen's Awards** to Industry, one for Environmental Achievement and the other for Export Achievement.

New diesel catalyst manufacturing facility opens in Royston.

Euro 1 emissions standards are introduced for gasoline cars in Europe.



1996

EU emissions regulations tighten with the introduction of Euro 2 emissions standards requiring the use of diesel oxidation catalysts.

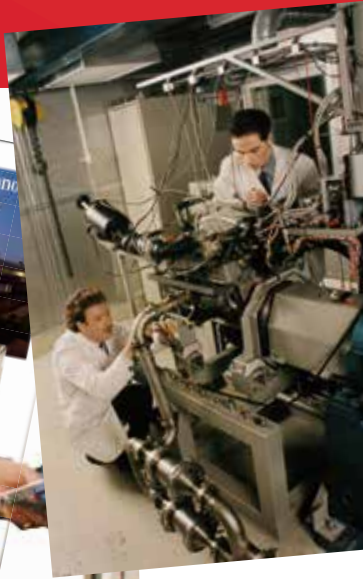
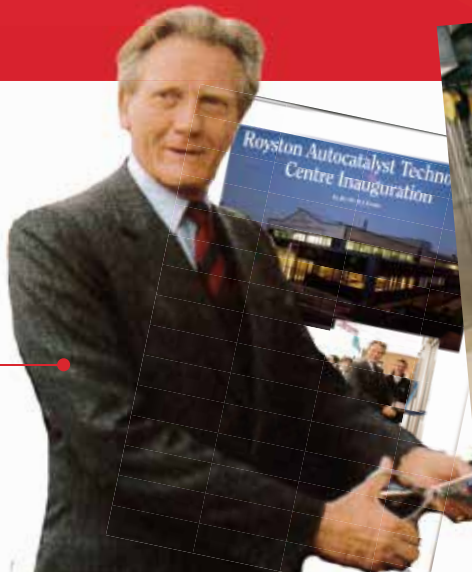
Plant Openings

- 1990 – Brussels, Belgium
- 1992 – Germiston, South Africa
- 1994 – Querétaro, Mexico
- 1996 – Nilai, Malaysia
- 1997 – Pilar, Argentina

1995

Johnson Matthey launches the Continuously Regenerating Trap (CRT®) System as a retrofit device for controlling emissions from heavy duty diesel vehicles.

Royston Autocatalyst Technology Centre is opened by Michael Heseltine, then President of the Board of Trade. The new facilities provide state-of-the-art laboratories and engine test facilities.



Expansion and new processes

At the end of the 1990s a new way of coating autocatalysts was developed. The 'precision coating' process, as it was called, revolutionised the way autocatalysts were produced. The first manufacturing facility to use this new process was opened in 2001 in Royston (Fastcat).

ECT was also recognised with various prestigious awards. In 2000, we won the MacRobert Award – the premier award for innovation and engineering in the UK. This was for our CRT® system which removes soot particles from diesel exhaust. In 2002 we received a highly regarded award from Honda for recognition of our work in autocatalyst development. And in 2009 we received two Queen's Awards for innovation and international trade. This was for our Compact Soot Filter for light duty diesel engines.

"The revolutionary precision coating process was developed in-house. It gave a step-change in PGM control and allowed advanced catalyst designs unavailable before to our scientists. Looking back it is a real landmark in the history of JM's autocatalyst business."

Neil Collins, Operations and Quality Systems Director (1993–present)

The first decade of the new millennium was a major period of growth for us. With our revolutionary precision coating process and new technologies we were able to open manufacturing plants in Royston (CSF1 and CSF2) and around the world. The Royston Autocatalyst Technology Centre was also expanded with new vehicle and engine test and catalyst preparation facilities. In 2005 Johnson Matthey's corporate HQ relocated from London to Royston.

2000

We receive **Millennium Product Award** & **MacRobert Award** for CRT® System.

Also in 2000, **EU emissions standards** for all petrol and diesel road vehicles become more stringent with introduction of Euro 3 regulations.



2002

Johnson Matthey receives this highly regarded award from Honda for autocatalyst development and the work contributed to this by Dr Barry Cooper.



2005

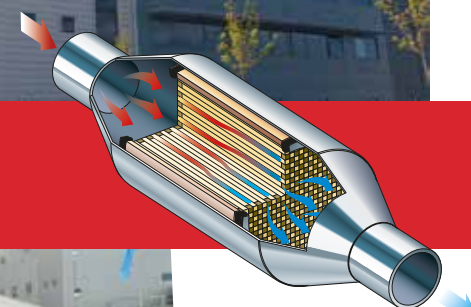
The Operations team in the new catalysed soot filter (CSF) manufacturing facilities installed in Royston (CSF1).

Euro IV heavy duty diesel emissions legislation is introduced. Several large OEMs use selective catalytic reduction (SCR) on their trucks.



2008

We acquire SCR catalyst company Argillon. New catalysed soot filter manufacturing plant (CSF2) opens in Royston.



2009

Johnson Matthey wins two **Queen's Awards** for Enterprise in both the Innovation and International Trade categories. Johnson Matthey was selected for its Compact Soot Filter for light duty diesel engines.

Euro 5 emissions standards are introduced. Particulate filters are required for diesel cars.



Plant Openings

2000 – Manesar, India

2001 – Shanghai, China

2008 – Jangan, Korea

2008 – Krasnoyarsk, Russia

2010 – Skopje, Macedonia

2010 – Smithfield, USA

2000

CSD supplies its 67 millionth catalyst to the European market, 9 million of which were made in Royston.

2001

New manufacturing facility (Fastcat) opens in Royston using the revolutionary precision coating process.



9M
00s

285 million – and counting

When our first catalysts left the Royston factory in 1974, who would have guessed that, in 2014, we would have supplied 285 million catalysts to the European market, 60 million of which were made in Royston? And that we now have 14 manufacturing facilities and 10 technology centres located around the globe.

In 1960, a brand-new British car would pump out over 100 grams of carbon monoxide, fuel hydrocarbons and nitrogen oxides, for every mile driven. Nowadays, thanks in large part to an unbroken series of world-leading innovations by Johnson Matthey scientists, typical emissions will be closer to one gram per mile.



DID YOU KNOW?

Since the first production plant opened in Royston in 1974, ECT's facilities have increased to include 14 manufacturing plants and 10 technology centres worldwide.

Naturally we're delighted that these innovations have kept us at the very forefront of clean air technology for so long, with a string of industry awards to recognise our achievements. But we're even prouder to move forward in the knowledge that, for forty years, we've helped make the world a cleaner, healthier place to live.

In 2014 we were honoured to be awarded with the Queen's Awards for Enterprise in Sustainable Development.

"We're winning the fight against diesel pollution now. The introduction of filters is why you see clean, chromed tailpipes on modern vehicles, instead of sooty ones pointing at the ground. The latest technologies will significantly reduce NO_x emissions to further improve air quality."

Chris Morgan, Technology Director
(1997–present)



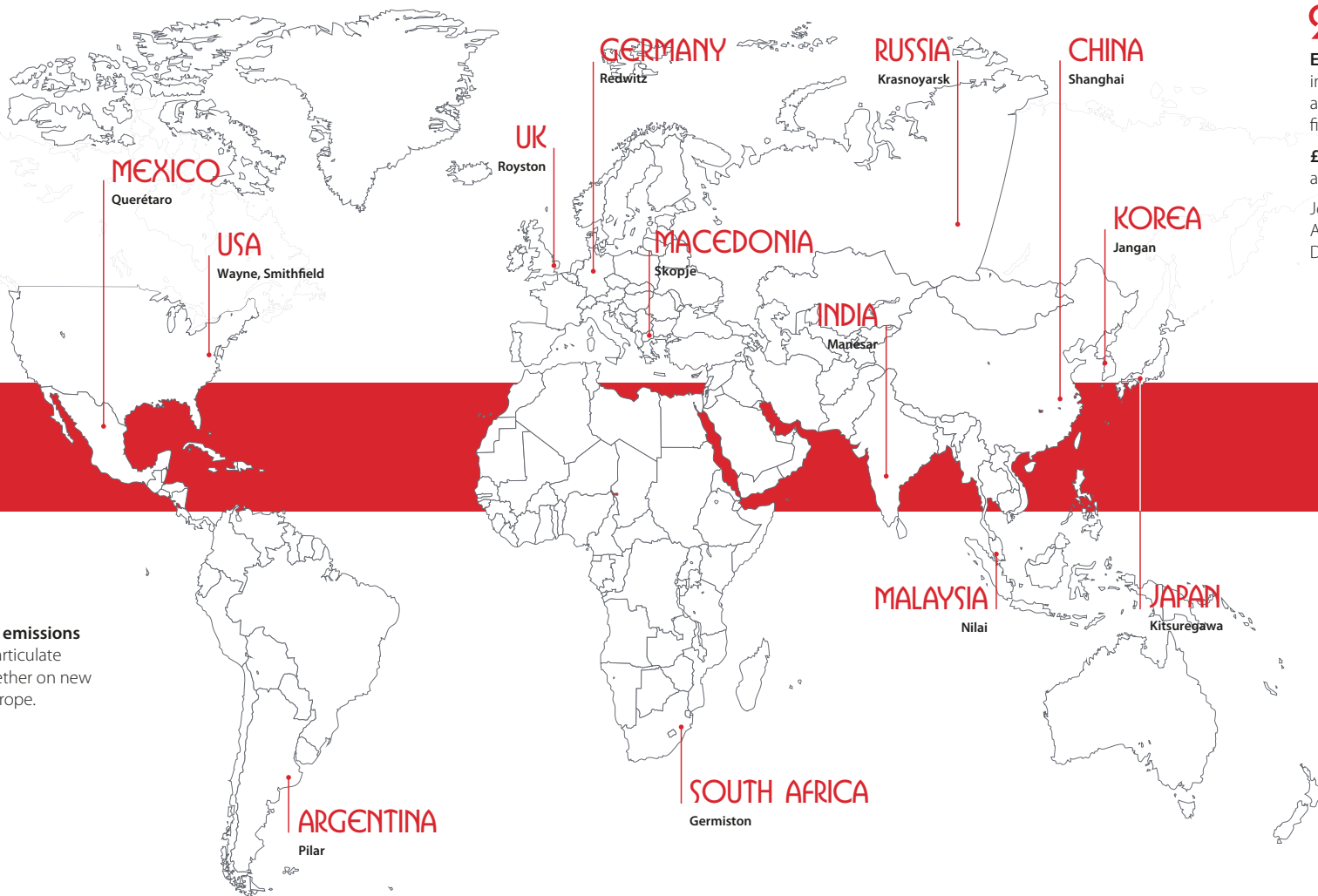
2012

ECT products appear in the *Make it in Great Britain* exhibition at the Science Museum. Held in the summer of 2012 the event celebrated the importance and success of British manufacturing.



2013

Euro VI Heavy Duty Diesel emissions legislation is introduced. Particulate filters and SCR are used together on new trucks for the first time in Europe.



2014

Euro 6 emissions standards to be introduced in September. NO_x aftertreatment is required as well as filters for diesel cars.

£40 million investment in Royston for a new SCRF® coating line begins.

Johnson Matthey wins the Queen's Awards for Enterprise in Sustainable Development 2014.

60M

2014

Johnson Matthey has supplied 285 million catalysts to the European market, of which 60 million were made in Royston. 14 million of those have been filters.



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