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SAFER GROWTH

HOW ADVANCED SCIENCE CAN HELP **SAFEGUARD**
CHINA'S PEOPLE AND ENVIRONMENT



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This white paper was created by *Fortune* Industry Perspectives and DuPont. It is the third of a series showcasing sustainable development thought leadership, which will help inform the discussions at the 2013 *Fortune* Global Forum, June 6-8, 2013, in Chengdu, China. For more information on sustainable development in China, please visit www.DuPont.com/FortuneGlobalForum.



Introduction

WANG YONG LEADS an emergency repair team at the Tarim oilfield in Xinjiang province, China. He works for CNPC, a large state-owned energy company. Part of Wang's job is to ensure that he and his colleagues manage physical risk and stay safe at work.

"Before every pipeline repair job, we communicate very thoroughly with every worker, including potential risks involved and related risk-control procedures," says Wang. "We educate them on how to prevent and control risks, to make sure all workers understand how they can protect themselves. This helps them feel safer at work."

In the past three years, Wang has overseen about 1,000 oilfield repair jobs, with no serious accidents to report. That's a good record by any standard. It speaks to China's emerging culture of industrial and public safety, an integral part of the national development vision that President Xi Jinping calls the China Dream.

China has undergone three waves of transformation in the modern era. First there was the inception of the

People's Republic in 1949, followed by the Cultural Revolution of 1966-76, followed by the great economic opening that began under Deng Xiaoping in 1978. This journey continues today with China's new wave of urbanization.

In China, economic growth and urbanization are two sides of the same coin. China's GDP is expected to quintuple between now and 2050 according to the IMF. By that time, the urban economy could generate more than 90% of China's economic output, up from 75% in 2009. The urbanization rate hit 49.2% in 2010 and is projected to reach 65.4% by 2025, according to United Nations research. By 2030, if current trends hold, around 1 billion Chinese will live in cities. McKinsey projects that by 2025, 13 of the world's 25 fastest-growing cities will be in mainland China. Between 2007 and 2025, the country's top 225 cities could generate 30% of global economic growth.

This rapid urbanization requires a massive expansion of China's infrastructure. Five billion square meters of road will be paved between now and 2030. Some 170 mass transit systems could be built,

IF CURRENT TRENDS HOLD, AROUND 1 BILLION CHINESE WILL LIVE IN CITIES BY 2030 AND 13 OF THE WORLD'S 25 FASTEST-GROWING CITIES WILL BE IN MAINLAND CHINA BY 2025.

along with 3.7 billion square meters of new office space in 5 million new buildings, of which 50,000 could be skyscrapers. That's the equivalent of constructing 10 New York Cities.

Rapid urbanization has helped lift the living standards of millions of Chinese, but it is also putting significant pressure on infrastructure, workplace safety, and the natural environment. In recent years, environmental issues have emerged as a leading cause of popular discontent in China. Last year, for example, authorities in

southern Sichuan province canceled the planned construction of a \$1.6 billion copper smelting facility in response to public concern about the project's environmental impact.

While these are all serious challenges, they are hardly unique to China. Over the years, DuPont and other multinational companies have developed technology and expertise that can help China maintain a rapid pace of urbanization and economic growth without sacrificing public health and safety. At the Tarim

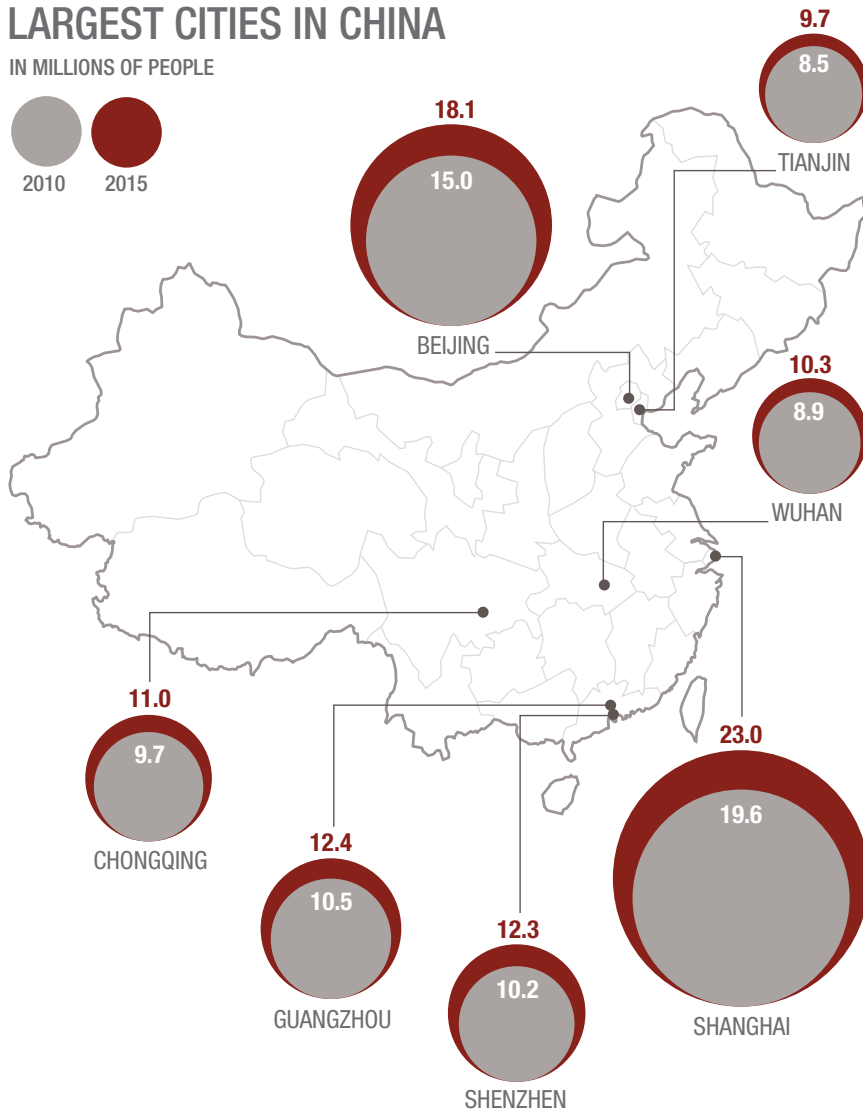
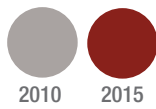
Oilfield, for example, consultants from DuPont Sustainable Solutions collaborated with CNPC to develop the safety-training regime that has helped Wang Yong achieve a perfect safety record. "Many of our consultants have experience in operations, and we're able to match that with our clients' internal structure and operations," says Jin Shouzhen, the lead consultant on the Tarim project. "This is



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LARGEST CITIES IN CHINA

IN MILLIONS OF PEOPLE



Source: UN "World Urbanization Prospects", 2011, released April 2012, Urban Agglomerations

RAPID URBANIZATION REQUIRES A MASSIVE EXPANSION OF CHINA'S INFRASTRUCTURE. FIVE BILLION SQUARE METERS OF ROAD WILL BE PAVED BETWEEN NOW AND 2030.

based on actual transfer of experiences and practice, not just theoretical concepts.”

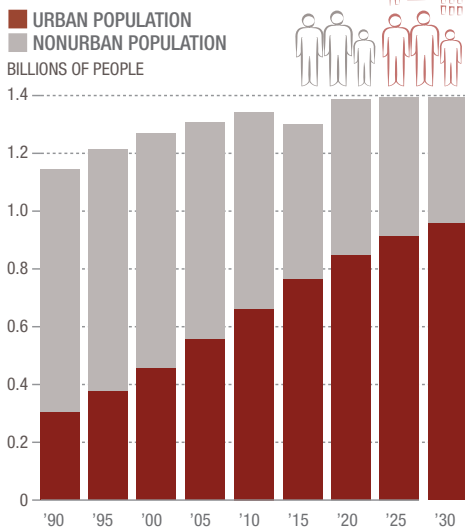
Proprietary DuPont materials such as Nomex® and Tyvek® are used in safety gear that helps protect Chinese firefighters and medical workers. In the construction industry, DuPont resins and glass interlayers help protect the structural integrity of Chinese roads,

bridges, and office buildings. In factories across China, hazardous smokestack emissions are reduced with help from DuPont scrubbing systems and fiber bed mist eliminators. The company also provides advanced food testing technology that helps safeguard the integrity of China's food chain.

Safety has always been important to DuPont. “We started out as an explosives manufacturer,” says Tony Su, president of DuPont Greater China. “We gained valuable experiences and learned tough lessons the hard way. Many of our products are designed to ensure people's safety and security.”

According to DuPont, the key elements of a sound protection strategy for China include making sure that the country's massive infrastructure buildout proceeds safely and sustainably, creating safer work environments, protecting the natural environment, and promoting public safety. This paper surveys China's four main protection challenges and presents scientific and technological solutions that are helping to address them.

URBAN VS. NONURBAN POPULATION



Source: UN "World Urbanization Prospects" 2011





China's 4 Protection Challenges

No. 1

BUILDING SAFE INFRASTRUCTURE

China faces significant challenges in creating infrastructure to support its rapidly growing urban population. The country currently spends 11.4% of its annual GDP on construction, transportation, and communications infrastructure, according to the Asian Development Bank. As part of a \$630 billion economic stimulus program launched in an effort to boost economic growth after the global financial crisis of 2008-09, the government announced a wide range of new urban infrastructure projects across the country, including new roads and bridges, subway systems, and high-speed rail links between major cities such as Beijing and Shanghai.

China's infrastructure buildout has raised safety concerns. In March 2012, for example, part of a high-speed rail line being constructed between the Yangtze River cities of Wuhan and Yichang collapsed

after heavy rain. Between July 21 and Aug. 21, 2012, there were 99 road cave-ins in Beijing alone, according to press reports. Bridges are another area of concern. By the end of 2011 there were nearly 689,000 bridges across China, some 58,000 of which were considered large or ultralarge—a category that accounts for 51.8% of the total length of China's bridges, according to a report in the state-owned *China Daily* newspaper. At least 37 bridges collapsed across the country from 2007 to 2012.

“With some bridges undergoing long-term, overburdened operation, we have been witnessing a high incidence of bridge accidents in the country,” the Ministry of Communications said in a statement. Recent bridge accidents include the ramp of the \$300 million Yangmingtan Bridge in Harbin, which had been in use for less than a year when it collapsed on August 24 of last year, taking four trucks with it. The accident killed three people and injured five.

In response, the Chinese government is working hard to tighten building codes and repair existing

EACH YEAR, CHINA USES UP TO 40% OF THE WORLD'S CEMENT AND STEEL TO ERECT A TOTAL OF 2 BILLION SQUARE METERS IN NEW BUILDINGS.

infrastructure across the country. More than 21,600 hazardous bridges were renovated between 2001 and 2012 at a total cost of nearly 44 billion yuan (\$7.05 billion), according to the Ministry of Communications. At a 2010 forum on green building construction, Deputy Construction Minister Qiu Baoxing noted that every year China uses up to 40% of the world's cement and steel to erect new buildings with a total area of 2 billion square meters. These buildings, however, have an average useful life of only 25 to 30 years. By contrast, U.S. commercial buildings are expected to stand for 70 to 75 years, according to the U.S. Department of Energy.

In addition to the obvious safety benefits of erecting more durable structures, it's in China's economic interest to extend the useful lives of buildings so that they can generate more revenue before they must be refurbished or torn down. As a result, the government and construction industry have increasingly been adopting international building codes and standards, and tightening enforcement of these standards nationwide.

No. 2

CREATING SAFER WORKPLACES

The government has passed a number of new workplace safety laws in recent years, notably the 2002 Law of the People's Republic of China on Work Safety. Workplace accidents have declined significantly in recent years, according to Wei Lijun, associate dean of the China Academy of Safety Science and Technology. Wei helped draft China's first national plan for production safety, which was included in the 11th Five-Year Plan (2006-10). He says accidental workplace deaths declined by nearly half (49.4%) between 2002 and 2010, a drop that he attributes to stronger safety regulations, enhanced emergency response capabilities, and a general rise in safety consciousness among the general population. "Safety first, prevention crucial" has become a policy embedded into people's hearts," says Wei.

The government has set aggressive workplace safety targets for the



12th Five-Year Plan (2011-15), notably a 15% drop in accidental deaths by 2015. However, China still faces significant challenges in protecting the health and safety of its large and growing industrial workforce. One major issue is that heavy manufacturing facilities continue to be located in densely populated urban areas. China's cities have suffered frequent industrial accidents in recent years, such as a 2010 gas explosion and chemical leak that killed numerous people and injured scores of others outside a plastics factory in the city of Nanjing. Last fall, several hundred employees of the Sunrex factory in Suzhou, the world's biggest supplier of computer mice and keyboards, were treated for chest tightness or distress, dizziness, or liver damage after maintenance workers mistakenly connected pipes that recycled paint to the drinking water supply system months earlier, according to news reports.

Although much work remains to be done, government statistics show an overall decline in workplace accidents in recent years. In 2012 the death toll from work accidents amounted to 71,983 people, a year-



TEH ENG KOON/APP/GETTY IMAGES



on-year decrease of 4.7%. The death toll from work accidents for every 100 million yuan of GDP was 0.142 people, a decline of 17.9%. Work accidents in industrial, mining, and commercial enterprises caused 1.64 deaths for every 100,000 employees, down 12.8%. And the death toll for producing 1 million tons of coal in coal mines was 0.374 people, down 33.7% year-on-year.

“We must treat production safety according to the law and treat enterprises according to the law,” says Shi Shaohua, an expert in production safety at the China Law Society. Shi notes that production safety is ultimately a social issue, because growth and modernization require a harmonious and stable social environment. “If workplaces are unsafe and workers die, families disintegrate,” he says. “Let’s say a young man dies in an accident, leaving his child and wife behind. Even if there’s financial compensation it will not last a lifetime, leaving behind a series of family problems and conflicts. Through accumulation, these family problems become societal problems.”

No. 3

PROTECTING THE NATURAL ENVIRONMENT

In recent years, China has made ambitious green tech investments and implemented successful efforts to curb energy consumption per capita. The government has also strengthened environmental regulations and canceled some subsidies to polluting industries such as coal extraction.

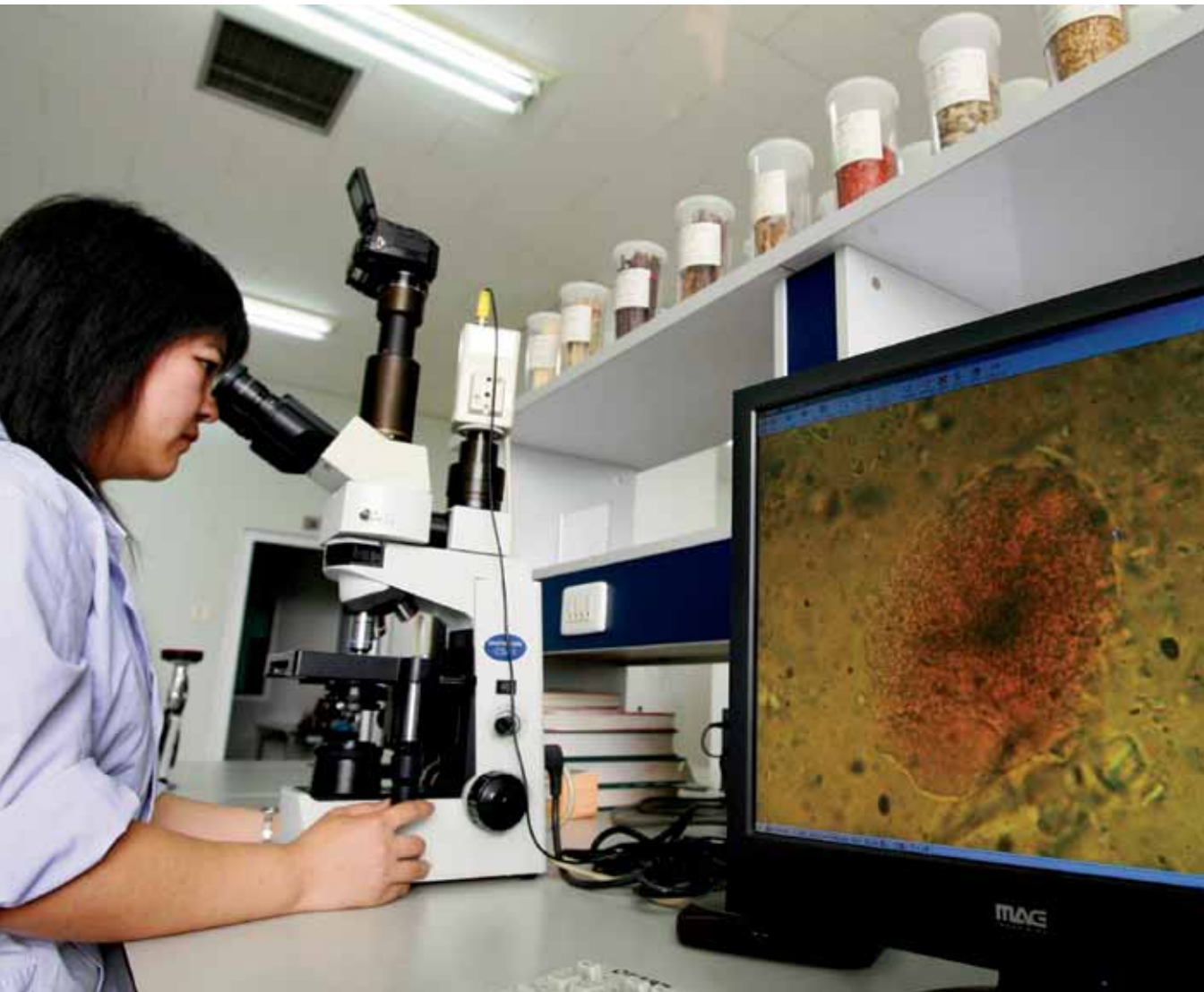
In a 2011 Gallup poll, 57% of Chinese adults surveyed said protecting the environment should take priority over economic growth. Many polluting industries, however, still have access to inexpensive land, water, electricity, oil, and bank loans. Most cities in China are ringed with heavy industry, metal smelters, and coal-fired power plants, all highly polluting but critical to maintaining economic growth. Expanding car ownership, heavy traffic, and low-grade gasoline are also major contributors to the heavy smog that frequently blankets most Chinese cities.

China’s environmental challenges

ROSS BROWN PHOTOGRAPHER



IN A 2011 GALLUP POLL, 57% OF CHINESE SAID PROTECTING THE ENVIRONMENT SHOULD TAKE PRIORITY OVER ECONOMIC GROWTH.



TEH ENG KOON / AFP / GETTY IMAGES

include air and water pollution, desertification, climate change, and threats to biodiversity. From an urban security perspective, air and water quality are probably the most salient issues. According to the World Bank, 16 of the world's 20 cities with the worst air quality are in China. The country also faces water supply shortages and pollution of existing supplies.

China's existing water supply system suffers leakage rates of around 50%, compared with 20% to 40% in many European countries and less than 7% in Denmark, a world leader in water management technology, according to a recent *China Daily* article. China is responding to these challenges by rapidly building out water infrastructure. In 2011, the government announced that it would invest 4 trillion yuan to build water resource facilities over the next decade, with a focus on sewage treatment, water efficiency, and groundwater protection.

No. 4

PROMOTING PUBLIC SAFETY

The rapid growth of China's cities has created a broad range of public safety challenges. Growing urban density and still-inadequate building codes put pressure on emergency response systems of all kinds, including firefighting, police, emergency medicine, and food safety inspection.

China also has a long history of large-scale natural disasters, including floods, earthquakes, and typhoons. Recent examples include the Sichuan earthquake of 2008, which killed more than 69,000 people and left at least 4.8 million homeless, according to government figures. The Chinese government has had emergency response systems in place ever since the inception of the People's Republic in 1949, according to Deng Yunfeng, a senior researcher with the Emergency Management Center at the Chinese Academy of Governance. In the early years, how-

ever, these procedures concentrated on helping individual work units deal with threats to their safety. The 2003 SARS epidemic stimulated the creation of a more comprehensive national system. In the past decade the government has passed numerous safety laws and also created an Emergency Response Agency that reports directly to the State Council. Its job is to coordinate emergency response policies nationwide.

The Emergency Response Agency was key to helping China respond to the 2008 Sichuan earthquake. “Our central government realized how important coordination and teamwork were when facing complicated national crises,” says Deng. Since then the agency has coordinated effective national responses to heavy winter snowstorms and industrial accidents, as well as national emergencies involving tainted food and milk. In the first half of 2013 the agency helped mobilize relief workers after another earthquake in Sichuan, and it also worked with public health authorities across the country to combat the latest outbreak of avian flu.



CHINA PHOTOS / GETTY IMAGES



A Vision for the Future

Targeted scientific interventions offer the best hope of reconciling China's economic growth imperatives with the need to provide safe public infrastructure, environmental protection, safe workplaces, and quality public health in the country's burgeoning cities. Here are some of the initiatives that the Chinese government, local companies, and multinationals, including DuPont, have undertaken across these sectors:

FASTER, SAFER TRAINS

China has invested considerable money and prestige in its high-speed rail network, which currently runs the world's fastest trains. In recent years, high-speed trains have dramatically cut travel times between major Chinese cities, according to Ji Jialun, a professor at Beijing Jiaotong University who also serves as secretary of the Transportation Committee of the China Railway Society. Today, China's high-speed trains travel at speeds up to 350 kph. As a result, a train trip from Beijing to Shanghai now takes about five hours, down from 30 hours in the 1960s.

"High speed means high risk,"

says Ji. "The faster the speed, the more serious the consequences of an accident." As a result, safety improvement has emerged as a central priority for the Chinese rail industry. The new motorized high-speed train cars are equipped with elaborate sensor technology. If a passenger smokes on the train, for example, the smoke signal will notify the car, causing it to slow down and stop automatically to prevent a possible fire on the train. Other systems monitor wheel tracking, stability, and seismic activity. Trains are programmed to slow down and stop in the event of an earthquake. "During transport, if something is not suitable, or not within standard, it will notify authorities," says Ji.

Numerous international companies are involved in China's efforts to upgrade its nationwide rail network. In 2011, for example, GE Transportation Systems signed a \$1.4 billion deal with China's Ministry of Railways to provide locomotives, service support, and railway signaling systems. DuPont currently provides Nomex[®] insulating paper that China Southern Rail (CSR) uses to protect the traction transformers on its high-speed

*TODAY, CHINA'S HIGH-SPEED TRAINS TRAVEL
AT SPEEDS UP TO 350 KPH.*



locomotives. “We chose Nomex® because we value its thermal stability and its high mechanical, electrical, and environmental performance,” says Cheng Hongsheng, manager of CSR’s Insulation R&D Center. “These features allow us to design a much smaller traction transformer and maximize its performance and efficiency.”

The traction transformer delivers grid energy to the train’s traction motor. It must transfer large power loads reliably while moving rapidly and withstanding frequent impacts, all while traveling through an external environment where temperatures can range from -40°C to +40°C within a single day’s travel. “Under these circumstances, if our transformer does not have reliable design, proper safety features, and material security, then it will easily be impacted by the energy grid,” says Cheng.

BETTER ROADS AND BUILDINGS

As high-density communities spring up all over China, the country faces significant challenges in building safe public infrastructure to accom-

modate soaring urban populations. Here DuPont is helping by providing advanced building materials used to construct safer and more durable structures. DuPont™ Elvaloy®, for example, is a range of proprietary resins used in building new, more durable roadways throughout China, protecting them against cracking and breakages. Using Elvaloy® RET, contractors can lay down modified asphalt that withstands extremes of heat and cold for longer-lasting roads.

Elvaloy® RET is supplied as free-flowing pellets that melt into hot asphalt to create a permanently modified asphaltic (bitumen) binder. An RET-modified asphalt remains easy to use but delivers improved long-term resilience and climate resistance. Unlike elastomeric additives that are merely mixed or suspended in asphalt, RET locks itself in during a fluid-stage reaction. The enhanced binder stays homogenous, with good aggregate coating and adhesion performance.

DuPont™ SentryGlas® is a polymer interlayer used to strengthen building glass. Manufactured by DuPont and sold as an interlayer to



XU CONGJUN / IMAGINECHINA

*MORE THAN 21,600 HAZARDOUS BRIDGES
WERE RENOVATED BETWEEN 2001 AND 2012 AT
A TOTAL COST OF NEARLY 44 BILLION YUAN.*



THE TOTAL COST OF AIR POLLUTION, WATER POLLUTION, AND SOIL DEGRADATION APPROACHES 10% OF CHINA'S ANNUAL GDP.

Chinese glassmakers, SentryGlas® helps create glass that protects against bigger storms, larger impacts, and heavier loads. It helps architects create beautiful, durable features like glass balustrades in stadiums, glass-bottom swimming pools, and typhoon-resistant glass for office buildings in coastal cities. Many newer buildings in Chinese cities now incorporate SentryGlas® interlayers in their construction.

CLEANER MANUFACTURING

China emits more greenhouse gases than any other country, due in large part to its heavy reliance on coal-fired power generation plants. China derives 70% of its primary energy from coal, and this dependence is expected to continue well into the future, according to a recent report by the World Resources Institute. Environmental degradation and resource depletion have taken a heavy toll on the Chinese economy in recent years, with the total cost of air pollution, water pollution, and soil degradation approaching 10% of annual GDP, according to joint research by the World Bank and the Chinese government.

Although overall air pollution levels have been on a steady downward path, the cost of treating pollution-related illnesses has climbed as the urban population grows and the overall population ages.

Numerous multinational companies are currently helping to improve the environmental performance of Chinese manufacturing facilities. In late 2012, for example, Dow Corning completed an expansion at its Shanghai Songjiang site, marking one of the largest single investments in China's paper release industry to date. By enabling local manufacturers to incorporate solventless silicone release coating products into their production processes, it allows them to reduce their environmental impact and comply with environmental regulations, according to a Dow Corning press release.

As a global science company, DuPont has developed advanced technology to help mitigate toxic emissions from manufacturing facilities. Today, numerous Chinese factories and oil refineries use DuPont Clean Technologies, including BELCO®, MECS®, STRATCO®, and IsoTherming®, to produce cleaner

*TODAY, DUPONT™ BELCO® SCRUBBING
TECHNOLOGIES ARE USED TO REDUCE EMISSIONS
IN OIL REFINING AND PETROCHEMICAL PLANTS.*



BLOOMBERG VIA GETTY IMAGES

fuels, reduce harmful emissions, and provide solutions that help protect people and the environment in a vast array of industries.

BELCO® scrubbing technologies, for example, are used to reduce particulate, sulfur oxide (SOx), and nitrogen oxide (NOx) emissions in oil refining and petrochemical plants. These technologies were originally designed for use under highly demanding conditions in refineries, which generally require three to four years of continuous operation with no shutdowns.

BELCO® scrubbers are primarily used in fluidized catalytic cracking units (FCCU), the core unit in any refinery. They are also widely used in reducing emissions from boilers and heaters. The flue gas stream from FCCUs, boilers, and heaters contains SOx, NOx, and particulates, three of the primary contributors to air pollution globally and in China. BELCO® scrubbers remove these pollutants from the flue gas stream using an alkaline solution that reacts with and neutralizes the SOx and NOx.

The market for so-called flue gas desulfurization (FGD) technology is growing rapidly. There are cur-

rently between 100 and 110 catalytic cracking units in Chinese refineries, according to DuPont estimates, all of which need FGD facilities. DuPont supplies BELCO® scrubbers to major Chinese petrochemical refiners, including PetroChina, Sinopec, and CNOOC. Outside of China, BELCO® scrubbers have recently been adopted in the marine industry, where ships with oil-fueled engines and boilers use them to eliminate harmful emissions in order to comply with varying environmental regulations in the ports where they call.

Chinese manufacturing facilities are also heavy producers of so-called mist emissions, which contain very fine particulates such as ammonium nitrate, nitric acid, phosphoric acid, sulfuric acid, and wet chlorine. Mist particulates are difficult to remove because of their very small size: less than three micrometers, versus 50 to 80 micrometers for the particulates in cigarette smoke.

There are various technologies available to remove mist from factory emissions, including wet electrostatic precipitators (WESPs), which use electricity to produce static charges that capture the mist. While effec-



tive, WESPs are expensive and can be maintenance-intensive. MECS® Brink® Mist Eliminators, supplied by DuPont, are an equally effective and far less costly solution that captures the mist in fiber filters. MECS® Brink® Fiber Bed Mist Eliminators were created specifically for submicron mist collection. Mist particles contact and collect on individual fibers in the Brink® Fiber Bed, then coalesce to form larger liquid droplets that drain from the downstream face of the fiber by gravity. There are no moving parts. Depending on the application, the Brink® Fiber Bed can have a life span of 10 to 15 years, or even longer in some cases.

DuPont is the only company that currently supplies Brink® Mist Eliminators, which were the very first fiber beds ever used in industry.

They have been deployed in China for more than 30 years.

HELPING FIRST RESPONDERS

Lin Ruihuang is a firefighter attached to the Second Squadron of the Special Police Unit in Shenzhen, a city in Guangdong province. Lin joined the Chinese army in 2003. He decided to become a firefighter after hearing about how courageous Chinese firefighters had helped the victims of natural disasters across the country, and about how American firefighters had helped victims of the 9/11 attacks. "That's when I realized that firefighters save lives as well as put out fires," he says.

Over the past few years Lin has fought fires all over Shenzhen as well as in neighboring regions. His

FIREFIGHTING SUITS MADE WITH DUPONT™ NOMEX® WON'T START DECOMPOSING UNTIL 400°C.

team takes about 45 seconds to gear up for a daytime emergency call. At night they need about one minute to don heavy fireproof suits, grab their walkie-talkies and other emergency gear, and climb into the truck. Lin has been in many dangerous situations, notably a 2005 gas line explosion on Shennan Boulevard, across from the Shanghai Hotel in Shenzhen. The gas pipe blew up while Lin and his colleagues were bringing water to the scene, injuring several bystanders.

In those days Lin and his team wore an older-model firefighting suit that let in a lot more heat. In about 2010 his squadron was equipped with a heavier suit made of DuPont™ Nomex®, the same fire-resistant material used to insulate traction transformers on CSR's high-speed trains. DuPont™ Nomex® is a unique aramid technology, that offers protection against heat and provides flame-resistance. Invented in 1962, Nomex® was commercialized between 1965 and 1967, according to Li Xuedong, applications research manager of DuPont Protection Technology for DuPont Asia.

DuPont also provides Nomex® for

use in flame-resistant suits for race car drivers. In one race a car caught fire. Because the driver was wearing one of these suits, he walked out of the burning car unharmed. That scene was broadcast on network television throughout the U.S. and helped create a much larger market for Nomex®. In addition to firefighting, Nomex® is used today in many applications where fire resistance is a priority, such as laminate floors and cabin walls in airplanes.

Li likes his job. "I feel very proud that our products help protect firefighters, whose jobs are to protect the public," he says. "Whenever there's an accident, they immediately rush to the scene to save lives and rescue properties. Every day when I go to work, I think how meaningful my job is for common people, which makes me very happy."

DuPont™ Nomex® fiber helps manufacturers design firefighting suits to protect wearers against hazards such as flash fire, pool fire, and molten metal splash. The material won't start decomposing until 400° C. It is stable for long-term flame resistance and thermal insulation at temperatures below 210° C.



“Nomex® is unique in that it doesn’t burn and it doesn’t melt,” says Tucker Norton, Asia Pacific technology leader for DuPont Protection Technologies. “So it actually gives you a fighting chance to get out of a fire alive.”

Local manufacturer U.protec supplies the Shenzhen fire department with suits made with Nomex®. U.protec is responsible for the design, manufacture, and quality control of the garments, as well as marketing. The company was founded in 2000, when the Ministry of Foreign Trade and Economic Cooperation passed new regulations requiring workers in 256 employment categories across six industries to wear fire-retardant garments on the job.

Today the company produces a wide range of protective garments in its 10,000-square-meter manufacturing facility in Shenzhen, according to U.protec general manager Wu Ying. “Our mandate is to provide technologically advanced protection garments for safety professionals,” she says. At peak capacity, Wu’s plant can turn out 600,000 protective garments and 200,000 firefighting garments a year.

U.protec and DuPont launched their relationship in 2006, when DuPont was looking to promote garments made of Nomex® in China. While petrochemical companies in China had been using fire-retardant suits made of Nomex® for many years, DuPont had not yet penetrated the firefighting and general public safety markets. “Before 2001, our clients were mostly firefighters in foreign countries because there was little demand for high-quality firefighting garments in China at the time,” Wu says. “Today our central government is paying more attention to the safety of firefighters, so demand for quality firefighting garments is increasing.”

After 40 years of development, DuPont has amassed a wealth of data on how Nomex® performs in firefighting applications. In the lab, for example, DuPont researchers apply precisely calibrated fire jets to the Nomex® Thermo-Man®, a mannequin dressed in Nomex® firefighting garments. “With our data analysis we can actually predict whether a person will get burned under certain circumstances wearing our garments versus those of our competitors,” says Norton.

AS CHINA BECOMES A MORE URBANIZED SOCIETY, FIRE AND OTHER EMERGENCY CHALLENGES WILL INEVITABLY AFFECT MORE PEOPLE.

As China becomes a more urbanized, densely populated society, fire and other emergency challenges will inevitably affect more people. Nowadays Lin's squadron responds to five or six fire emergencies a week around Shenzhen. He feels much safer in his new uniform. "If our clothing and equipment aren't well designed, we can't protect ourselves, which means we can't protect others," he says.

China's new safety culture is emerging in many sectors where workers experience daily risk associated with their jobs. For example, Chinese medical workers wear hazmat suits made from DuPont™ Tyvek®, which provides an impermeable barrier against dangerous particles. During the SARS epidemic of 2003, the government deployed thousands of medical workers wearing disposable white Tyvek® suits donated by DuPont. And many Chinese law enforcement personnel now wear helmets and vests made from DuPont™ Kevlar®, an aramid fiber that is five times stronger than steel on an equal weight basis. In China's auto industry, many workers wear safety gloves made of DuPont™

Kevlar® that allow them to handle sharp-edged metal components without worrying about slashing their hands.

Kevlar® has many applications beyond human safety. Today it reinforces data transmission cables hung underneath China's vast electric power grid, protecting against breakage and thus reducing data transmission outages. Several Chinese auto manufacturers use Kevlar® to make transmission belts and other components where strength and durability are vital. These applications illustrate the DuPont company's broad understanding of protection. "It's not just protecting people and the environment," says Norton. "It's also about protecting the critical systems that surround us each and every day."



MIKE CLARKE/AFP/GETTY IMAGES

Conclusion

Protection is a journey, not a destination. As high-density communities spring up all over China, the country faces huge challenges in building safe public infrastructure to accommodate soaring urban populations. China must also maintain the integrity of the food chain and continue to take steps to improve the quality of its air and water. Finally, China's workers deserve every effort that their employers and the government can make to improve workplace safety, so that the men and women who are creating China's growth can reap the rewards of their hard work.

None of this will be easy. But if the government and the private sector work together, there is ample reason for hope that one of the great economic and social transforma-

tions in history can be accomplished with minimal impact on human health, worker safety, and the natural environment.

DuPont is ready to do its part. "For the past two centuries, DuPont has been applying cutting-edge science to make the world a safer and better place," says company chair and CEO Ellen Kullman. "We look forward to providing the technologies that will help safeguard Chinese health, happiness, and prosperity in coming years."



View the video of
DuPont's contribution to
the future of protection
in China.



IN PARTNERSHIP WITH:

