The science of crowd counting
Event safety and risk analysis
A mixed picture

In an unprecedented opportunity to understand the difference in pay between men and women across the UK, more than 10,000 employers have provided data to illustrate just how big the gap is.

Construction and the finance industries have been revealed as having the widest gender pay gaps, but the identity of some of the better performers would surprise many, even though some are dominated by men in terms of employee numbers.

Analysis of the 10,016 employers who submitted data required by the Equality Act 2010 (Gender Pay Gap Information) Regulations 2017 revealed that almost eight out of 10 pay men more than women (see page 5). There was no sector that paid women more than men on average, and the data showed that women were being paid a median hourly rate that, on average, was 9.7% less than that given to their male colleagues.

But the water supply, sewerage, waste management and remediation sector was among the best performing areas of the UK economy for salary parity with a mean gender pay gap of 5.5%. In terms of median pay gap, accommodation and food services was the best performer (1%). While in the public sector, which used mean rather than median figures, female NHS staff in England earn nearly a quarter less than their male colleagues.

Among the advice offered to women about how to tackle the gender pay gap in their own places of work in the wake of the unsurprising revelations has been the suggestion that they should join a union. But as the deadline closed for organisations to report their gender pay gaps it was revealed that several of the unions themselves had pay gaps above the national average of 18.4%. Only the TUC – which appointed its first female leader, Frances O’Grady, in 2012 – reported that it had no gender pay gap.

Our feature on page 14 looks at the progression of women in the workplace, and how the landscape is changing. But as Jan Hall says in our interview on page 22, it’s not about women versus men – it’s about people.
AI ripe for exploitation, experts warn in new report

Drones turned into missiles, fake videos manipulating public opinion and automated hacking are just three of the threats from artificial intelligence in the wrong hands, according to a report.

The Malicious Use of Artificial Intelligence, compiled by experts from a number of institutions including the University of Cambridge and research firm OpenAI, argues that in the wrong hands, AI could be exploited by rogue states, terrorists and criminals.

The 100-page report identifies three areas – digital, physical and political – in which the malicious use of AI is most likely to be exploited.

The report calls for:
- policymakers and technical researchers to work together to understand and prepare for the malicious use of AI
- a realisation that, while AI has many positive applications, it is a dual-use technology and AI researchers and engineers should be mindful of and proactive about the potential for its misuse
- best practices that can and should be learned from disciplines with a longer history of handling dual use risks, such as computer security
- an active expansion of the range of stakeholders engaging with, preventing and mitigating the risks of malicious use of AI.

"For many decades hype outstripped fact in terms of AI and machine learning. No longer. This report looks at the practices that just don’t work anymore – and suggests broad approaches that might help.”

Dr Seán Ó hÉigeartaigh, Executive Director of the Centre for the Study of Existential Risk and one of the co-authors, says: “Artificial intelligence is a game changer and this report has imagined what the world could look like in the next five to 10 years.

“We live in a world that could become fraught with day to day hazards from the misuse of AI and we need to take ownership of the problems – because the risks are real. There are choices that we need to make now, and our report is a call to action for governments, institutions and individuals across the globe.

“For many decades hype outstripped fact in terms of AI and machine learning. No longer. This report looks at the practices that just don’t work anymore – and suggests broad approaches that might help: for example, how to design software and hardware to make it less hackable – and what type of laws and international regulations might work in tandem with this.”

Contributors included OpenAI, a non-profit research firm, digital rights group The Electronic Frontier Foundation and the Center for a New American Security, a national security think-tank.
**Brexit**

**May calls for UK to stay in EMA after EU exit**

Britain’s Prime Minister has unveiled a plan to seek “associate membership” of the European safety agencies on chemicals, medicines and aviation after Brexit.

Theresa May called for the UK to remain part of the European Medicines Agency (EMA) after Brexit. The proposal chimes with the wishes of the biopharma industry, but it remains to be seen whether the European Union is receptive to the idea.

May discussed the UK’s future relationship with the EMA in a speech that gave the clearest picture of her position to date. May wants to “explore ... the terms on which the UK could remain part of” the EMA and certain other European agencies. The Prime Minister sought to paint the arrangement as a win for both the UK and the EU.

“The UK regulator assesses more new medicines than any other member state, so the EU would continue to access the expertise of the UK’s world-leading universities”

“Membership of the [EMA] would mean investment in new innovative medicines continuing in the UK, and it would mean these medicines getting to patients faster as firms promote larger markets when they start the lengthy process of seeking authorisations,” May said. “But it would also be good for the EU because the UK regulator assesses more new medicines than any other member state. And the EU would continue to access the expertise of the UK's world-leading universities.”

Every month the UK sends 45 million packs of medicines to the EU, which sends 37 million to the UK, according to Chief Executive of the Association of the British Pharmaceutical Industry.

Cooperation on medicines regulation between the EU and UK is vital for patients at home and across Europe, Mike Thompson said.

Research by the Association of British Healthcare Industries (ABHI) shows that of £5 billion worth of health technology used in the NHS in 2016, £3.2 billion came directly from the EU. The UK exports around £2 billion of health technologies to the EU.

Currently products move seamlessly across the UK/EU border in complex supply chains, pointed out the association, but any disruption to this could pose a significant risk to patients if not properly managed.

**Worker involvement**

**Prison workers unfairly fired for raising safety fears, tribunal rules**

An employment tribunal has found that two “whistleblowers” who raised safety concerns over maintenance work at Liverpool Prison were unfairly dismissed by contractor Amey.

John Bromilow and Harry Wildman, who worked at the jail for more than 20 years, were fired by Amey, which had the contract for prison repairs.

Amey claimed they brought the firm into disrepute by discussing new working practices with the prison governor.

But an employment tribunal ruled that the men were unfairly dismissed.

The men had complained about changes Amey introduced to the way they carried out repair work, painting jobs and other maintenance tasks in the prison.

The company had taken over maintenance at Liverpool Prison in June 2015 as part of a government contract to provide facilities management in 60 jails.

Under the changes, staff were required to carry out most jobs alone, rather than in pairs, as had been the practice for many years.

The two men thought it was a safety risk because tools and equipment could be snatched by prisoners.

“I see it as a bag of tools, somebody else will see it as a bag of weapons,” said Bromilow, a painter and decorator.

After unsuccessfully trying to reverse the measures through an internal grievance procedure, the two colleagues met the prison governor.

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Gender pay gap figures revealed

Final gender pay gap figures for large companies in the UK have been revealed after the deadline expired for firms to report their findings.

More than three-quarters of UK companies pay men more on average than women, initial analysis of the figures suggests. The data reveals men are paid more than women in 7,795 out of 10,016 companies and public bodies in Britain, based on the median hourly pay. Across the companies and organisations that had filed their reports, eight out of 10 had a gender pay gap.

According to the Equalities and Human Rights Commission, 1,557 firms missed the reporting deadline. All companies, charities and public sector bodies with more than 250 employees were required to submit their gender pay figures by 4 April 2018.

The equalities watchdog will investigate those firms that fail to comply and could take legal action against them, with penalties including an unlimited fine.

Meanwhile, research by international services provider Sodexo claims to have found that teams managed by a balanced mix of men and women are more successful across a range of measurements, including employee engagement and health and safety.

The five year study of 70 Sodexo teams with different functions represents 50,000 managers worldwide and tested the performance implications of gender-inclusive work culture.

The research examined women across all levels of management – not just upper-level leadership positions – in order to investigate the ‘pipeline’ that will ultimately affect gender balance at the top tier of businesses.

Analysts found a direct correlation between the percentage of women in the total workforce and those in management, indicating gender-balanced workforces and leadership create an environment supportive of career growth for women. They said this lent support to the idea that gender parity in top leadership was closely related to the pipeline of women in the workforce.

IN COURT

Poundworld’s rodent infestation and broken lift cost £1.2m

The Croydon branch of discount chain store Poundworld has been ordered to pay almost £1.2 million for health and safety breaches and food hygiene offences at its rodent-infested store.

Mouse urine and faeces was found on products and packaging, some of which had been gnawed and taped back together, at the shop in south London in February 2016.

The basement and storage areas were also found to be contaminated with mouse droppings, while some areas were in darkness with “very poor visibility”.

Officers said staff had to carry items up to the shop floor because the goods lift was out of commission.

Additionally there was no hot water, inadequate heating and poor housekeeping, which resulted in stock being left in a “haphazard and dangerous manner”, they reported.

At Croydon Crown Court, Poundworld admitted five food safety offences and two breaches of the Health and Safety at Work Act in a prosecution brought by the London Borough of Croydon.

Last month it was fined £660,000 for the food safety offences, and £500,000 for one of the health and safety offences. It must also pay costs of £30,409 and a victim surcharge of £500.

The court heard that Poundworld, in May 2015, had been acquired by Poundworld Bidco on behalf of funds controlled by TPG Capital, a global private equity investment firm with assets worth more than $80 billion.

The court requested more details about TPG, but this request was declined by Poundworld’s counsel on the basis that, in this representation, Poundworld, TPG and other companies are not linked organisations.

“The degree to which this company failed to uphold cleanliness and safety standards in its premier town-centre store beggars belief, and the financial penalty imposed is ... entirely justified”

However, Her Honour Judge Smaller said: “In the absence of being given sufficient reliable information, I am entitled to draw reasonable inferences that Poundworld can pay any fine.”

Councillor Hamida Ali, Cabinet Member for Communities, Safety and Justice, said: “I am pleased to see that by imposing such a substantial level of fines and costs, the courts take seriously the matter of food retailers’ responsibility to ensure they adhere to legal requirements designed to protect the health and safety of their customers and staff.

“The degree to which this company failed to uphold cleanliness and safety standards in its premier town-centre store beggars belief, and the financial penalty imposed is – to most people’s minds, I’m sure – entirely justified.”
THAILAND

Twenty migrant workers killed in bus fire

At least 20 people have died after a double-decker bus erupted in flames in Thailand.

The vehicle, which was carrying migrant workers from Myanmar, was heading to a factory in an industrial zone near Bangkok when the fire broke out.

Police Lieutenant Raewat Aiemtak said 27 people managed to escape the blazing vehicle, with one of them severely burned.

The cause of the fire wasn’t immediately known, but Raewat said the driver reported the fire started in the middle of the bus and spread quickly. People in the front managed to escape but those in the back of the vehicle were trapped.

Thailand has the second-highest rate of traffic fatalities in the world after Libya, according to World Health Organization statistics. The WHO estimates a rate of 36.2 per 100,000 population. By comparison, the rate in the UK, with a comparable population, is 2.9 per 100,000, and in the US it is 10.6 per 100,000.

CHINA

Govt to dismantle work safety dept

The Chinese government is to abolish the State Administration of Work Safety (SAWS), merging its functions into a new national Emergency Management Department, it has been reported.

According to Xinhua News Agency, the ministry will be responsible for compiling and implementing emergency management plans, as well as organising rescue and relief for disasters and workplace accidents. It will also be in charge of work safety and the prevention and control of fire, flood, drought and geographical disasters.

China Earthquake Administration and State Administration of Coal Mine Safety will be affiliated to the new ministry, while the State Administration of Work Safety will be dismantled.

“The move seems to confirm the suspicion that, on the issue of work safety, the Chinese government is more concerned with disaster management and control rather than in preventing workplace accidents in the first place,” said the China Labour Bulletin.

Canada

Hydro-Québec faces $4m lawsuit over worker’s 2015 death

Family members and former colleagues of a man who died on the La Romaine construction site on Quebec’s North Shore are suing Hydro-Québec for $4 million in damages.

Steeve Barriault drowned on 11 March 2015 when the excavator he was driving fell through an ice-covered pit filled with water. Barriault was working for Neilson-EBC, a construction company contracted by Hydro-Québec, to do excavation work on the site of its hydroelectric dam project.

It is alleged that Hydro-Québec didn’t carry out tests to ensure the ice field on which Barriault was working was safe.

They also allege there wasn’t any security personnel monitoring the site when the accident happened in the early hours of the morning.

EUROPE

EU-OSHA launches work diseases hub

The European Union’s think-tank on workplace health and safety is targeting prevention of work-related diseases with a new website section.

Though the number of workplace accidents has decreased by 25% over the last 10 years, work-related diseases still account for an estimated 2.4 million deaths worldwide each year, 200,000 of which are in Europe.

EU-OSHA’s work on work-related diseases aims to provide an evidence base for prevention, policy and practice. See https://osha.europa.eu/en/themes/work-related-diseases for more information.

RUSSIA

Security firm ‘illegally took on fire protection obligations’

A private security contractor known as ‘Protection Center’ that worked in the Zimnaya Vishnya shopping mall in Kemerovo which caught fire recently illegally undertook additional obligations on fire protection, according to local news reports.

Chief Expert at the Main Directorate for Licensing of the Federal National Guard Troops Service, Svetlana Ternova, told reporters that the security contractor had neither experts nor equipment for carrying out preventive firefighting measures.

The shopping mall in the Siberian city claimed the lives of 64 people, including 41 children, and injuring 79 people, with 27 children among them. According to earlier reports, several versions are being investigated, including short-circuit failure and arson.

Seven people have been arrested.

2.4m deaths are caused by work disease
GLOBAL

US deaths from lead exposure ‘10 times higher than thought’, study suggests

Exposure to lead at levels a fraction those permitted in UK workplaces puts workers at a greatly elevated and previously grossly underestimated risk of deadly heart disease and other health effects, research has revealed.

The US study found that those individuals in the top 10% for their initial blood lead concentration had a 37% increase in all-cause mortality and a 70% increase in cardiovascular disease mortality compared to those with a blood lead concentration falling in the lowest 10%.

Published in The Lancet, the report, *Low-level lead exposure and mortality in US adults: a population-based cohort study*, tracked more than 14,000 adults over a period of about 20 years. Of the survey respondents, 4,422 had died by 2011. The researchers calculated that approximately 18% of those deaths could have been prevented by reducing blood lead concentrations to 1.0 micrograms per decilitre.

QATAR

‘Lethal’ lifting equipment failed British worker, inquest hears

A British worker employed by a South African subcontractor working in Qatar’s Khalifa International Stadium and world cup venue was killed because the lifting equipment he was relying on was in a “lethal” condition, a UK coroner has said.

Zac Cox, 40, died in January 2017 after he fell 40 metres (131ft) from rigging when a catwalk he was helping to install at the Khalifa stadium in Doha collapsed. The accident occurred after lever hoist equipment failed, causing part of the platform on which Cox and a colleague were working to fall.

The coroner, Veronica Hamilton-Deeley, told Cox’s inquest in Brighton: “Many managers knew and should have known they were effectively requiring a group of their workers to rely on potentially lethal equipment.”

She said the changes introduced to speed up the installation of the catwalks were “chaotic, unprofessional, unthinking and downright dangerous”.

Hamilton-Deeley added that “a perfect storm of events” led to Cox’s death, including a decision by the contractors to speed up the building of the stadium’s roof. That move required the use of additional lever hoists that a fellow construction worker told the inquest were only worthy of the rubbish bin.

The coroner said: “If you cut to the quick, the root cause of the accident was that the workers were being asked to use equipment that was not fit for purpose. Horribly simple, really.”

AUSTRALIA

Nurse’s murder ‘was work-related’

South Australia’s health and safety regulator has reclassified nurse Gayle Woodford’s death as work-related and reopened its investigation.

A remote-area nurse with almost five years’ experience, Woodford was on call in the remote community of Fregon on 23 March 2016 when convicted sex offender Dudley Davey lured her out of her high-security home and raped and murdered her.

Despite Davey admitting that he had drawn Woodford out of her home with the ruse that his grandmother needed a painkiller, SafeWork SA informed her family that her death was not work-related.

Since the death, Nganampa has removed the personal risk assessment framework and put in place a community escort system so that patients don’t present to nurses’ houses, and nurses are never on call alone.

GLOBAL

Pollution putting millions of infants at risk of brain damage, UNICEF says

Seventeen million children under the age of one are breathing toxic air, putting their brain development at risk, the UN children’s agency has warned.

Babies in South Asia are worst affected, where pollution is six times higher than safe levels. Millions more are at risk in East Asia and the Pacific.

The UNICEF report, *Danger in the air*, also reveals that more than three-quarters of these young children – 12 million – live in South Asia, where outdoor air pollution exceeds six times international limits set by the World Health Organization.

“Not only do pollutants harm babies’ developing lungs – they can permanently damage their developing brains – and, thus, their futures,” said UNICEF Executive Director Anthony Lake.

“Protecting children from air pollution, not only benefits children. It also benefits their societies – realised in reduced healthcare costs, increased productivity and a safer, cleaner environment for everyone.”
CROWD ANALYSIS

What’s the best way to plan if you don’t know how many people are coming to an event? We speak to crowd analysis expert Professor G.Keith Still, who says it only takes four questions following the crowd.

The political frenzy surrounding the number of people attending US President Donald Trump’s inauguration in 2017 inadvertently brought the science of crowd counting to public and media attention. But the question of whether, as the White House claimed, this was the “largest audience to ever witness an inauguration, period” is beside the point. In safety terms, what matters is that crowd size, flow and density are crucial to event planning and ensuring appropriate resources are available.

Estimating crowd numbers, evaluating density and understanding safe limits are integral to risk mitigation. When the New York Times asked Dr G.Keith Still, Professor of Crowd Science at Manchester Metropolitan University, and his team to evaluate the crowds at both Trump’s inauguration and the subsequent women’s march in January 2017, they used RAMP (route, area, movement and profile/people) analysis together with car park and Metro user data to evaluate crowd build-up in real time.

For decades, Still and his colleagues have applied RAMP analyses to make predictions for events as diverse as the Chelsea Flower Show, the London New Year celebrations and the Sydney Olympics, but when they were asked to do it live for the Trump inauguration, they did not realise the furore that would ensue. At
that time, there were various claims that three million people would attend, but that simply wasn’t true – the space wasn’t big enough for a start. “We evaluated that 168,000 to 196,000 were actually there,” he explains.

He generally finds that people overestimate crowds by about ten-fold. “One of the reasons for this is that politicians and the press love big numbers. One million is a magic figure.” During the planning for the wedding of the Duke and Duchess of Cambridge, for example, Still and his team knew the capacity of the mall was only 60,000 to 100,000 people. “It didn’t matter what the press was saying,” he stresses. “Our planning was to the actual site capacity.”

“You have the media wanting to make an event look huge but never really doing an accurate count,” he adds. “When it comes to practical planning and organising, we work with various event organisers, the police and others to make sure they’ve got the right resources for the crowd. Here’s the risk: organisers think they are managing three million people, yet there are really only 700,000, so when someone says: ‘How many resources did you use for that three million?’ and they say x number, when you scale it down you find you’re grossly under-resourced. That’s why crowd counting is so important: if you think you’re managing a crowd that is five or ten times larger than is actually there, you can end up totally under-resourcing those smaller events.”

**Occupying space**

While crowd counting can be useful after the event, Still focuses on dynamic estimation (using RAMP techniques), which allows real time predictive estimation and risk mitigation. The key questions (see www.gkstill.com/CV/Projects/Counting.html) involved in developing a crowd dynamics plan and risk assessment are:

- **Route:** From which direction will crowds approach and leave? What are the transport hubs to and from the site?
- **Area:** What is the event capacity? How much area is there and, importantly, how will it be used?
- **Movement:** How quickly will the spaces fill? What crowd movements do you expect and over what period?
- **People/profile:** What type of crowd are you expecting? What do you know about the audience demographics?

With this data, event organisers can examine where, when and how congestion might build up, where queues may be expected and where they need to position stewards and security.

“You can estimate area and density,” explains Still, “and we already have a good idea how certain types of crowds fill and occupy space. For instance, with a popular boy band and a youthful audience, you generally get high density close to the front of the stage.” Book signings will have a different type of crowd gathering, as will store openings, various other promotions or football matches.

“So we look at the areas they occupy and how the
profile fits various ground spaces, and we look at how movement over time occurs,” says Still. “We look at how people get to the site, such as the rate at which the car parks are filling over time. If you plot that and ask: Is it a flat line? Is it a rising straight line? Is it a growing curve? This gives you some idea, just by a simple extrapolation, of what it’s going to look like in the next half hour or so.”

Public transport capacity can also be used. “We knew for example that certain London Underground stations around the royal wedding could deliver 40,000 people an hour, so we can use that information to look at the maximum load that can be pushed into the site and how we can monitor that,” Still explains.

All about the numbers
One of the reasons some controversy often follows a crowd count is that the count is generally realistic and produces lower numbers than hoped. “It’s essential to get this right however, because the reality is that if you don’t you could be putting lives at risk by under resourcing future events,” advises Still.

Another event where the crowd was probably hugely overestimated was the Eagles Victory Parade. “Three million people was the estimation by the organisers,” says Still. “We evaluated that 700,000 were actually there. You need to know what you’re looking for and to have the right angles and field of view. From the front, for example, if you’re low and looking through, it can look as if a crowd is disappearing over the horizon.”

Moving crowds need more space for safety than those that are standing, which makes it important to understand the difference between static and dynamic space requirements. A safe crowded space is normally estimated at two people per square metre, adjusted for areas of higher density (front of stage, for example). Where crowd density increases above five per square metre, the risks of slips, trips and falls, crowd surging and crowd collapse increase.

The relationship between crowd density (people per square metre) and crowd flow (people per metre per minute) is critical. In moving crowds, as density increases above a critical density (which is different for different crowds/events but typically 2-3 people per square metre), the flow rate begins to drop. Crowd flow also differs according to the degree of crowd order. Marching soldiers can achieve a higher flow rate at higher densities than a mixed crowd.

“Density and flow are related, which is obvious if you think about it,” argues Still. If you’ve got people walking down a corridor, as the numbers increase the density increases and the space between them reduces. They then can’t take whole paces, so they walk more slowly; the flow rate reaches a maximum and then drops off again.” High density crowds move more slowly and therefore any compression points very quickly become high risk environments.

Estimating crowd numbers, evaluating crowd density and understanding safety limits for event capacity is an essential requirement for crowd safety and risk analysis. Where crowd counting can be very useful (after the event) Still’s team focuses on a dynamic estimation process (using the RAMP analysis techniques). This allows for real-time predictive estimation and risk mitigation for places of public assembly.
Victim of success
It is useful to track attendance at regular events and extrapolate. “For London New Year 2006, the site capacity was 180,000,” says Still, “but a quarter of a million turned up, which raised issues about what to do.” The following year, 360,000 came and the year after that 550,000. “It’s about understanding at what point the system breaks,” he says. “About understanding what your site capacity is and what the curves look like in terms of growth.

“It’s not complicated maths. It is complex, bringing several connected parts together, but once you’ve put those bits together, you’ve got crowd science”

“Free, non-ticketed events can often take on a life of their own, becoming a victim of their own success. That’s great if you are planning and anticipating but, if you’re not, the day that there are too many people on your site is the day that lives are at risk, so it’s always a question of being able to keep some eye on how the crowd momentum is building year after year. And that’s about basic data collection – basic statistics.

“We teach police officers and event organisers how to evaluate crowd numbers and make sure if they see numbers build up, they’ve got time to react and take remedial action, and how to plan for crowds that are 50%, 100%, 300% or 500% more than expected.”

This leads to the question of at what point it might be necessary to divert people elsewhere. “We advise shutting these kinds of events at 80% full, and then we evaluate what the next 20 minutes or half an hour are going to look like,” Still says. “We might have 50% of capacity at a particular flow rate. When you reach 50%, you go from green to amber; that’s your get ready, and then 80% is your lock down. If you lock down at 80%, you can inform the crowd, make decisions, look at what’s on route and what’s already in the spaces. Whereas if you shut something when it’s full, you build up pressure. You want to be shutting in advance and diverting people before pressure builds up – that’s how to mitigate risks.”

Early warning signals are crucial. “The disasters usually occur when there are too many people and not enough space,” says Still. “So you’ve got to have an understanding of the basic maths, and that’s something that seems to be lacking in many cases. But if you are from an operational research or safety background, you know how important it is to get these numbers right.

“It’s not complicated maths,” he emphasises. “Rather it is complex, bringing several connected parts together. But once you’ve put those bits together, you’re left with a very good idea of how to plan and manage safely, and that’s what we call crowd science.”
Falls from height still account for the largest percentage of fatalities at work, but is TV and film any safer? We speak to specialists in the production industry to find out

Paul Greeves
Managing Director,
1st Option Safety Group

Last year saw several serious incidents of performers being injured or killed after falling from height. An acrobat was injured at Legoland in Windsor while performing in the Pirates of Skeleton Bay when he failed to grab on to a pole and fell several metres to the ground. In a separate incident, Pedro Aunión Monroy, a performer from Brighton, was killed at the Mad Cool Rock Music Festival in Madrid during a routine when he fell around 100ft to the ground. Finally, stunt performer John Bernecker died after he fell head first onto a concrete floor from around 22ft during a rehearsal for a stunt on The Walking Dead.

The HSE describes working at height as ‘Work at height means work in any place where, if precautions were not taken, a person could fall a distance liable to cause personal injury’. Essentially a fall from height has to involve a fall from one level to a lower level but does not include walking up and down a permanent staircase in a building.

We all know that, where reasonably practicable, the Work at Height Regulations require us to eliminate work at height entirely. Of course this is not always possible so where working at height cannot be avoided employers must to ensure that suitable and sufficient measures are in place to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.

Stunt work is just one of numerous examples of working at height within our industry ranging from being on a stage to working in a lighting grid to filming on a roof to filming near a cliff edge. All work at height must be properly planned and so because of this, different controls are going to be appropriate depending on the findings of your risk assessment.

Where eliminating working at height isn’t possible film production companies need to look at preventing people from falling in the first instance. This will include the use of barriers to isolate people from the potential fall. Where that isn’t practicable the use of harnessing and fall arrest systems should be considered to prevent access to edges. Finally, the use of exclusion zones should only ever be considered after a full assessment of the risk and where none of the other previous controls are appropriate.

Mobile elevated work platforms (MEWPs) such as Genie booms, ‘cherry pickers’ and scissor lifts, and material handling equipment (MHE) such as telehandlers are commonly used in TV and film production for lighting, set support and other uses. In a drama production in February last year, two genie booms rigged with 20 x 20 frames on a drama location were blown over and brought down a third in an unexpected strong gust of wind. Luckily no one was injured and the production had multiple controls for working with MEWPs in place including:

- Ensuring that exclusion zones were put in place around the machines when elevated
- Checks on operators to ensure that they were suitably trained
- Operating the MEWPs in line with manufacturers guidelines and best industry practice
- Use of hand held anemometers to monitor wind speeds
- Checking the expected weather and wind speeds the day before shooting
Frames were rigged by competent and experienced riggers using accepted working practices.

The incident was investigated by the HSE, which decided not to prosecute in this case, but several key lessons were identified in the investigation and additional measures were put in place by the production team for future shoots using MEWPs.

**Specific limits**

The safe working limits for the specific MEWP/MHE being used must be known and adhered to. This should include the reduced wind speeds when items such as frames are attached. This information is available from manufacturers for some models, but not for others so you need to ensure your use is safe and can demonstrate that in the event of an accident.

**Weather information**

When MEWPs/MHEs are being used in exterior locations detailed information on expected wind conditions should be obtained over and above the normal reporting for production call sheets. Attention should also be paid to how wind is affected around large buildings.

Monitoring of wind speeds – when lifts are elevated wind speeds must be monitored from the highest and most prominent point rather than at ground level. This should be done using an anemometer that can be mounted on the platform and then read from the ground rather than using hand held devices at ground level.

**Sufficient crew**

Enough crew should be available at all times to lower the MEWPs quickly if the wind increases.

**Wind speed recording**

Productions should have a way of recording wind speed on a regular basis by using a Wind Speed register or similar system. Daily records should be kept identifying times when the equipment was lowered as a precaution due to wind. These instances should also be notified to senior management.

Paul Greeves is Managing Director of 1st Option Safety Group: [www.1stOptionSafety.com](http://www.1stOptionSafety.com)
Breaking down the barriers

We look at the progression of women in the workplace

The last 60+ years have seen the numbers of women in the workplace increase hugely since they entered the economic system to supplement the male earning capacity lost to two world wars.

Before the conflicts, the role of females in society was different. Women were expected to stay home to take care of their children and perform household chores, while the men were the breadwinners. However, post-war this ideology began to shift as women started to enter the workforce.

Complex social movements contributed to this change – the feminist movement, equal opportunities legislation, the expansion of the service sector and the knowledge economy, and the ever increasing cost of living and increased access to education.

Changing the landscape

Women have never been in a stronger position to lead, change and shape the economic, social and political landscape. The 21st century has seen a dramatic shift in “traditional” family dynamics and greater recognition of gender in legislation has helped pull apart gender-role divisions. As a result women are far more economically independent and socially autonomous, representing 42% of the UK workforce and 55% of university graduates. Yet women are still less likely than men to be associated with leadership positions in the UK: they account for 22% of MPs and peers, 20% of university professors, 6.1% of FTSE 100 executive positions, and 3% of board chairpersons. This stark inequality is consistently reflected in pay gaps, despite the introduction of the Equal Pay Act in 1975. Income inequality has risen faster in the UK than any other OCED country and today women earn on average £140,000 less than men over their working careers.
A mixed picture
This rise in numbers has resulted in women entering a much broader range of occupations, from mainly supportive, nurturing roles such as teaching and nursing to every walk of occupational and professional life – women are now found in occupations, industries and roles previously regarded as the sole prerogative of men, such as STEM (science, technology, engineering, and mathematics).

But there is a mixed picture across the core STEM workforce. While it is positive to see an increase of 13,000 more women working in core STEM occupations, the proportion of the workforce made up by women has decreased from 22% to 21% since 2015. This demonstrates that some progress is being made, but as the STEM sectors continue to grow, the rate at which women are taking up jobs does not compare to that of men.

This difference in female employment patterns since the 1940s has had a significant impact on the economic empowerment of women, but perhaps even more importantly there has been a sea change in their wider contribution to society.

There is plenty of work still to do, not just at the level of the labour force but at the educational end of the pipeline too. Ultimately female representation in STEM occupations is a composite of demand and supply. The supply of qualified STEM women emerging from further education – either university or apprenticeships – is not trending upwards and until it does, we will not see the breakthrough that will change the face of industry.

#MeToo #NotOkay #TimesUp
You’d have had to be living under a rock if you haven’t heard the rally cry against sexual harassment over
A major challenge is that women who are victims of discrimination don’t want to talk about it publicly. They are scared they will be branded a trouble-maker and that speaking out will turn potential future employers off.

With celebrities continuing to speak out against the likes of Hollywood and with further accusations made against business leaders and politicians, the global conversation about sexual harassment in the workplace has accelerated at an incredible pace which does not look likely to slow down or stop.

Social media campaigns such as #NotOkay and #TimesUp continue to play a prominent role in the public eye and in people’s personal lives with new stories continuing to emerge on a daily basis – empowering those affected to speak out with less fear of detriment to their career from voicing concerns.

It is therefore very likely that 2018 will be a year when businesses employ a significant focus on sexual harassment in the workplace. With this being the case, it is worth going back to basics to consider what actually constitutes sexual harassment in the workplace and what employers should be doing to ensure that they are compliant – both morally and with current legislation.

**Pregnant then screwed**

Discrimination against pregnant women in the workplace is something which most people might assume belongs firmly in the past, a relic of a bygone, politically incorrect era with no bearing on modern life. Yet thousands of women are forced out of their jobs due to pregnancy every year.

- Fifty four thousand women lose their jobs for becoming pregnant and 390,000 working mums experience negative and potentially discriminatory treatment at work each year. These numbers have doubled in a decade.
- Discrimination tends to have a negative impact on a woman’s confidence and mental health. This often has a long term impact on their career and sometimes this has a negative impact on their relationship with their child and partner.
- Motherhood is a major contributor to the gender pay gap with the gap for young women and men being almost non-existent, but the gap widens consistently for 12 years after the first child is born, by which point women receive 33% less pay per hour than men.

‘Pregnant Then Screwed’ is a movement which aims to raise awareness of pregnancy discrimination in the
72% OF WOMEN FEEL PRESSURED TO SUCCEED AT BOTH WORK AND HOME

UK. The online platform allows women to anonymously submit their own experiences of pregnancy related discrimination in the workplace to demonstrate how systemic the problem really is.

Let’s talk about pay
The World Economic Forum’s most recent Global Gender Gap Report still predicts gender parity is a good couple of centuries away. Yes, that’s 200 years – not 20.

If you envision the world two centuries from now, you might be picturing flying cars, artificial intelligence, virtual realities, maybe even a new human colony forming on Mars. Your imagination can run wild attempting to predict what the workforce of the future might look like. By this time, we might all be wearing productivity measurement technology, working alongside AI colleagues, conferencing with holograms, and best of all, women will have finally achieved equal pay! You read that right. Data suggests women won’t reach pay parity until 2235.

That’s a depressing realisation to say the least, but it’s not set in stone. HR professionals are paying attention, and they’re making an effort to close the gap much sooner, thanks to the gender pay gap reporting requirements which took effect in April 2017, and gave employers 12 months to comply.

As employers now have to make salary information publicly available to customers, employees and potential recruits, it is hoped that they will take new or faster action to reduce or eliminate their gender pay gaps.

What does the future look like?
Whether it be the gender pay gap, cases of sexual harassment or a lack of representation in the senior management positions of companies, the discrimination of women is a continued issue that some firms are starting to pay stronger attention to. The world economy is losing out on $12trillion (£9.6tn) in global GDP over the next decade as a result of gender inequality, according to the McKinsey Global Institute, with a cost £150 billion a year to the UK economy in 2025 alone.

Considering the reputational impact that a claim brought against a company could have – not to mention the moral obligation to ensure that employees feel safe and are properly protected within the workplace – it is essential that all businesses, regardless of their size, consider their procedures for identifying and dealing with complaints of gender discrimination.
• EMPLOYMENT LAW

Notice periods during probationary employment

I have started a new job and am in my probation period. Can I still be dismissed if it doesn’t go well?

A probation period can be seen almost as a ‘try before you buy’. The purpose is generally to highlight a period when both the employer and employee can assess whether they have made the right decision and if the role is suitable.

Generally the notice period for either party during this period is less than it would be once the probation period has expired. It is important to check your contract to understand what this is. If the contract is silent, statutory notice applies which means during the first month, if your contract is terminated, no notice is required to be given. After one month the notice period is one week.

If your contract is terminated during this time, it must be done in accordance with the terms of your contract and should not be done for a reason which is automatically unfair in law. Visit www.gov.uk/dismiss-staff/unfair-dismissals for a brief outline of the types of issues which may be considered automatically unfair.

Sickness absence: back to work meetings

I have been sick and off work for three weeks and have been invited to a meeting to discuss my absence. Is this fair?

An employee who is off work for four weeks or more is generally considered to be on long term sick and how an employer approaches the situation may depend on the reason for the absence, your length of employment, the size of the business and your role within it. Unless there is a medical reason why you cannot attend the meeting it would be reasonable to expect you to do so.

• CONSUMER RIGHTS

Dissatisfied with building works

I have had some work done to my property but it has gone wrong; how to I take action against the builder?

Any work done by a business trader is covered by the Consumer Rights Act 2015 and as such should be of ‘satisfactory quality’ and if not the contracting party has to put it right. If this is not done, or not done to your satisfaction, leading to a breakdown in the relationship it may be possible to take an action in the small claims court.

In order to do so you should first send your builder a letter before claim in accordance with the relevant Pre-Action Protocol (PAP) found at www.justice.gov.uk/courts/procedure-rules/civil/rules/
Pregnant workers and noise exposure

An employee is 16 weeks' pregnant and occasionally works on a flashcutter machine, which has a maximum noise of 85.2 dba. Can this affect her foetus?

The Control of Noise at Work Regulations don’t specifically address risks to the foetus. There is a requirement in the regulations to give particular consideration in the risk assessment to any groups who may be at particular risk from noise exposure, including new and expectant mothers; this reads across to the requirements on this in the Management Regulations, and there is an HSE publication (see attached document) that provides a critical review of the literature.

Even though the HSE make a recommendation for further studies, it appears that any effects of noise on reproductive outcome are most probably mediated by the mother’s response to noise and thus the provision of hearing protection to reduce noise exposure may reduce any adverse effects. Maternal stress in response to noise may also play a role so it is important to reduce stress levels rather than noise per se.

A more recent publication by HSE is HSG122 “new and expectant mothers at work” refers to noise as follows:

- There appears to be no specific risk to new or expectant mothers, but prolonged exposure to loud noise may lead to increased blood pressure and tiredness.
- No particular problems for women who have recently given birth or who are breastfeeding.
- The requirements of the Noise at Work Regulations 1989 should be sufficient to meet the needs of new or expectant mothers.
- You must ensure that workers who are pregnant, who have recently given birth or who are breastfeeding are not exposed to noise levels exceeding national exposure limit values.
- Noise at Work Regulations 1989 apply to all workers exposed to loud noise where there is a risk to hearing.

It should be noted that the 1989 Regulations have been replaced by the Control of Noise At Work Regulations 2005 (in force from 2006). The “action” levels in the 2005 Regulations are reduced by 5 dB compared to the 1989 Regulations.

If the pregnant woman is exposed to noise from a machine at 85.2 dB (LAeq) over an eight hour shift (which may include 45 minutes in breaks) and a background sound level in the mid to high 70’s dB (LAeq), her daily noise exposure (LEP,d) may reach the Upper Exposure Action Level in the 2005 Control of Noise Work Regulations. However, as she is occasionally exposed to this noise level and on other days she is exposed to lower noise levels, the weekly average noise level may be below the Upper Exposure Action Level but unlikely to not reach the Lower Exposure Action Level. Assuming her weekly noise exposure is likely to reach the Upper Exposure Action Level her employer ought to:

- reduce her exposure to noise by technical or organisational means;
- provide her with personal hearing protection, and ensure she makes full and proper use of it as required;
- provide her with information, instruction and training on noise, the risk to her hearing, and how to obtain and use hearing protection;
- consider placing her under a programme of health surveillance for hearing damage.

If her weekly noise exposure is likely to reach or exceed the Lower Exposure Action Level, her employer is expected to:

- reduce her exposure to noise by technical or organisational means;
- provide her with personal hearing protection, and ensure she makes full and proper use of it as required;

For further information, visit www.hse.gov.uk/noise/employers.htm
CONTINUING PROFESSIONAL DEVELOPMENT

There’s still time to book these great CPD courses

A different way of learning

- 6 June, London and 20 June, Cardiff
- £175 + VAT

Our Design Risk Management workshops, in partnership with the Royal Institute of British Architects (RIBA), have been a great success. We have been in London, Birmingham, Edinburgh so far, with workshops still to be held in Cardiff and again in London in June.

The CDM 2015 Regulations were introduced to change the way we think and deal with construction design risk management on a day to day basis. Significant risk identification, proportionality, less unnecessary bureaucracy, better team working and better project management encourages quality and value for everyone. But there are still issues with understanding and communicating effectively.

The workshops offer a different way of learning. With delegates working in teams on case study projects, it’s interactive, thought provoking and is a great way for those already familiar with the CDM Regulations to enhance their skills.

Delegates work together to analyse the detail and work collaboratively to identify significant risks, mitigate their impact, record the significant findings and produce suitable information to communicate with others.

“I really enjoyed the course, the facilitators had a good breadth of knowledge and experience, and the workshop groups worked really well as delegates had a solid platform to learn from other businesses’ experiences”

Protecting your people

- 13 June, London
- £175 + VAT

We are very much looking forward to a special day of learning with Andy Neal, Associate Director of Security at Cardinus Risk Management in June.

Andy has provided some great insights to the Institute over the last year on increased risks posed by terrorist threats and potentially hostile environments. IIRSM believes that safety, risk, security and health professionals need an enhanced understanding of how to identify and mitigate the risks, develop new policies and provide training and support to protect their workforces and business.

Andy has designed and delivered strategies on counter terrorism, lone working, global travel safety, overt–covert security operational training and procedures. Featuring a fantastic case study delivered by Hugh Kempton, European Safety Manager at CHEP Europe, you will develop your understanding and skills in this important area.

IIRSM holds a range of events in the UK and Internationally – for more information and to book your place visit: www.iirsm.org/events
A proliferation of ‘unthinkable’ events over the past four years has revealed a new fragility at the highest levels of corporate and public service leaderships. Their ability to spot, identify and handle unexpected, non-normative events is shown not just to be wanting but also perilously inadequate at critical moments. They threaten careers and reputations. They are potentially existential for both corporates and governments. This is what top leaders have confided to in an ongoing study.

The examples of the ‘new normal’ keep stacking up. They include Brexit; the inadequate, belated handling of Europe’s migration crisis; the implications for many energy producing nations and energy corporates following on from the turbulence in oil prices; and the new fragility of political stability as traditional parties are challenged by the new disruptive age of public disillusionment, digital empowerment, algorithms, artificial intelligence and an overall challenge to all that has been assumed to be rules based.

And then there’s US President Donald Trump with his unique approach to policy making and “draining the swamp”. Like the UK’s shock vote for Brexit, Trump’s unpredictable style of leadership confirms the impact of the new normal of unthinkables. Worryingly, other leaders around the world are watching. They are wondering: can they use the same method to govern?

These challenges pose big questions about the appropriateness and configuration of the executive human capacity of those at the highest levels to both cope with – and respond to – this new proliferation of ‘unthinkables’. New evidence confirms how pressures often overwhelm executive capacities at high speed, and in an ever more compressed timescale.

To hear more, come to IIRSM’s annual conference – book your place at www.iirsm.org/events
During her 35 years working in health and safety, Jan Hall has seen much change.

“When I first used to go to meetings, it was usually accepted that the women would make the tea while the men sat around puffing on cigars,” she recalls. “It’s very, very different now.”

Jan began her safety career almost by accident. An administrator working for a nursing home, one morning she made a coffee for one of the directors who was passing through on his way to court. The director told Jan that the company faced a health and safety charge and he wasn’t sure which way to plead.

“I was a union rep at the time, so I offered to have a look at the paperwork. I read the papers and I told him, ‘The company is clearly guilty of the breach so you should plead guilty.’ He did, and the judge commended him for the plea. The judge imposed a very, very small fine – I think it was £500 when it could have been up to £20,000 – and told my director ‘to take the rest of the money and spend it on health and safety advice.’ Following the hearing, the director came back and asked me if I wanted to train to become a health and safety professional within the company. I agreed straightaway.”

Train and reward
A “complete health and safety novice”, in her own words, Jan applied to RoSPA for a scholarship – writing 500 words on why she should be awarded it. There were many applications, and Jan won one of six awards, enabling her to take her NEBOSH Certificate for free.

Jan enjoyed health and safety right from the beginning: “For the first time in my career, I felt I was making a difference.” Jan’s employer, Springboard, operated 90 individual sites, including social housing and nursing homes, and she was responsible for health and safety management of the entire portfolio. “I set up a scheme where each of the 90 workplaces had a key person [who was responsible for health and safety day-to-day at their site]. Every year, I brought all 90 key contacts together so I could train them. It was quite an innovative approach at the time.”

To make sure she was an effective trainer, Jan studied for a City & Guilds teaching qualification in adult education. “It’s one thing having the knowledge,” she points out, “but you need to be able to train people.”

The annual training for key contacts took place over a few days, and covered everything from legislative changes to discussions about any incidents or problems the different sites had experienced.

Jan believes a positive relationship between health and safety departments and management is key to good safety management.
performance. “I worked at Springboard for 17 years and the company really invested in risk management. I was very well supported and educated. If I said there was new legislation coming and I needed training to prepare for it, they would say, ‘Fine’. Asbestos was a big issue at the time, so I had training in that. I was always able to attend conferences and seminars to further my knowledge.”

While working at Springboard, Jan was elected Chair of the Essex local authority health and safety committee – the first time someone from social housing had been appointed to the position, which she held for four years. Then, in 2002, Jan won a European Week for Health and Safety national award in recognition of her work on stress in the workplace.

When Springboard was taken over by a larger company, Jan moved into health and safety consultancy, taking a position with RB Health and Safety Solutions in Hastings which had recently won a contract to work with the Delfont Mackintosh Theatres. The timing was ideal for Jan, who had long been involved with amateur dramatics – and, in her spare time, had begun to support organisations within the field, including the National Operatic and Dramatic Association (NODA), with their risk assessments.

“I was conscious that in amateur dramatics, people hadn’t really got to grips with safety. But it was around the time that people were becoming more aware: theatres started to ask about things like certificates for lighting rigs, costume materials, things like that. So I helped out with risk assessments, writing papers, and so on. I mentioned my work with NODA on the application form for the consultancy role, and I got the job! I was a good fit, and I loved the work.”

“Health and safety is simply about putting common sense into common practice”

In her new role, Jan concentrated on the theatre contract – alongside other contracts within the entertainment industry, such as with the Chickenshed theatre – and was also responsible for pitching for new business. The theatre group was keen to see bespoke safety training for employees, so Jan worked with colleagues on the design of a theatre-based course, IOSH Managing Safely for Theatre and Production.

RB was given unprecedented access to theatres and staff with the result of the course accreditation. “It means people working in theatre no longer have to attend a generic course where they learn how to handle boxes; instead they can attend a course where they learn to handle set,” she says.

Good relations
Jan had to retire due to ill health, but she maintains her involvement in health and safety on a voluntary basis. She approached the Grand Opera House in Belfast to offer her experience and expertise, and now works there for around a day each month.

“It’s a lovely relationship. Having supported the changes, such as the introduction of the health and safety forum and first aider group, together with providing information for the safety management system, staff feel free to seek advice on an ad hoc basis.

“Even though I am retired, I’ve kept up my knowledge through membership of professional bodies such as IIRSM and I feel I have more to give back.”

Over the years Jan has seen the role of women in risk management completely transformed. “In the early days, I’d go to meetings and there would be maybe three women among dozens of men. But attitudes – and representation – seemed to improve quite quickly: suddenly there were 20 women in the room and things were more balanced.”

Through her public speaking she encourages women to put themselves forward. “It’s not about women versus men, though: it’s about people,” she adds. “Everyone has a voice.”
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