

**bsi.**

...making excellence a habit.™

# Diversity in Personal Protective Equipment (PPE)

---

A whitepaper



# Diversity in Personal Protective Equipment

## Contents

- 1 Introduction
- 2 Not just small men
- 3 Economies of scale
- 4 More than just comfort
- 5 Empowering the workforce
- 6 Conclusion
- 7 About the Author
- 8 Acknowledgements



# Introduction

PPE (Personal Protective Equipment) is not a modern concept. Human beings have been making equipment to protect themselves for hundreds of millennia. There are numerous examples from across history – many related to warfare. Even in this field there are examples of provision for a more diverse group, including women. Perhaps one of the most famous example is the suit of armour provided by Charles VII of France for Joan of Arc. And yet, the provision of PPE that genuinely takes into account the needs of a truly diverse workforce remains poor.

## Not just small men

Whilst Joan's suit was custom made, most PPE that is available for the workplace is based on generic anthropometric data. Generally if you are outside of the 5th or 95th percentile, then the hope of finding anything to fit is low, whether male or female. There is anthropometric data for both men and women from across all parts of the world. Whilst much of this data is old and does not fully reflect modern body frames, it does cover men and women and shows quite clearly that women are not just small men. Women's feet aren't just smaller but are narrower, so a small size 'male' safety boot is unlikely to fit a female foot. The same is true for a safety glove in 'small'. If not designed specifically for women, the palm area will be too big and the fingers too long and wide. Simply making something a bit bigger or a bit smaller does not address diversity needs. Additionally, anthropometric data is limited to a few metrics and does not provide a complete anatomically accurate picture.

The next challenge is that standards written for PPE often fail to take into account a more diverse end user. Health and safety is an industry which has a predominately male demographic, although this is changing. The experts that develop the standards come from this demographic, which means there can be a lack of diversity on the committees that write PPE standards around the world.

These committees do also have to rely on the existing anthropometric data, which as mentioned, has its limitations. The outcome is that the standards to which PPE manufacturers have to comply often restrict the ability to make PPE that is suitable for women or different ethnic backgrounds.

The 2006 report 'Personal Protective Equipment For Women – Addressing the Need'<sup>1</sup> reported that the "CSA revised its safety footwear standards to allow shoe-makers to manufacture Grade 1 boots in narrower widths without sacrificing the level of protection offered to workers with small feet...These changes have had a positive impact in increasing the availability of women's safety footwear."

Other examples of standards committees becoming more diverse are available. For instance, the UK Committee PH/3/11 Protective Equipment for Sports Players which mirrors the European committee CEN/TC 162/WG 11 Body protection for sports, includes input from both males and females and is chaired by a woman. The standards which they are responsible for developing are increasingly accounting for diversity of all types. In fact, the UK National Standards Body, BSI, has a project to identify all standards that need to have a 'personal' aspect to them – and this includes not only gender and cultural

diversity but also religious, disability, medical and other forms of body differences such as amputees.

It is in the area of respiratory protective equipment (RPE) where we are seeing actual change to cater for diversity. Because there is a critical need for respiratory products to fit the user properly, there has been a large ISO project to produce a set of respiratory standards that reflects up-to-date research on face shapes and gender. Data used showed that there was a big difference in facial characteristics between Caucasian, sub-Saharan and European facial types. In other words, the new standard is written with the human in mind.

Part of the output was ISO 16900-1:2014 Part 1: Determination of inward leakage. This standard isn't referenced in the 'official journal' (reference list for harmonized standards) but is defining the way the respiratory standards are going. The ISO standard specifies an increase in the number of test subjects from 10 (as is normal for most European standards), to 25 in order to provide greater representation of human diversity. Any testing against the standard also needs to take into account different breathing patterns while performing various physical tasks. This is also having an impact on tests where human subjects are not used (just models) with the introduction of five test headforms for things like breathing tests to accommodate different face shapes and sizes.

ISO 16900-1:2014 standard also refers to another standard – ISO/TS 16976-2:2015 Respiratory protective devices – Human factors. Here the focus is on determining whether the RPE is fit for purpose based on how and where it is used.

**This means, for the first time human factors come into the equation, including:**

- Ergonomics
- Work rate
- Dead space in the device
- Work of breathing
- Thermal effects
- Psychological effects
- Speech transmission

One of the most important physiological factors is how much air the wearer needs. The ISO standard uses a staggered scale of work rates. This means that a respirator is classified according to how hard the wearer can work without 'over-breathing' the device (breathing too hard for the device).



## Economies of scale

The final barrier to better choice of PPE for a more diverse workforce is economic. The provision of a suitable selection of PPE to meet all sizes and sexes is market driven – the economics of cost versus return. In simple terms, historically there was no money to be made in PPE for a diverse minority of the workforce. Take for example women. A boom of women entered the workforce in the 1960s and continued to surge through 1999 where it peaked at 60% of the workplace being comprised of female employees<sup>2</sup>. Now the global labour force participation rate for women is 50 per cent, compared to 76 per cent for men<sup>3</sup>. Where women are the predominant workforce, the provision of PPE designed for women is significantly better, for example in healthcare or the equine industry, or in countries where women are more evenly represented across all industries, such as Sweden.

The challenge arises in those industries where women are under-represented. Here, the market forces have meant that the economics of providing a comprehensive selection of PPE for women have simply not been there. Where the female workforce is restricted to a single supplier, as is often the case with employer procurement contracts, finding PPE that fits correctly becomes challenging. Whilst most of the large PPE suppliers in high income countries do now provide some sizing for women, the choice is limited. This means that the 'personal' in PPE becomes null and void, as women are unable to try on a range of PPE to find the equipment that best fits them and is comfortable.

More worryingly still are the reports of women covering the

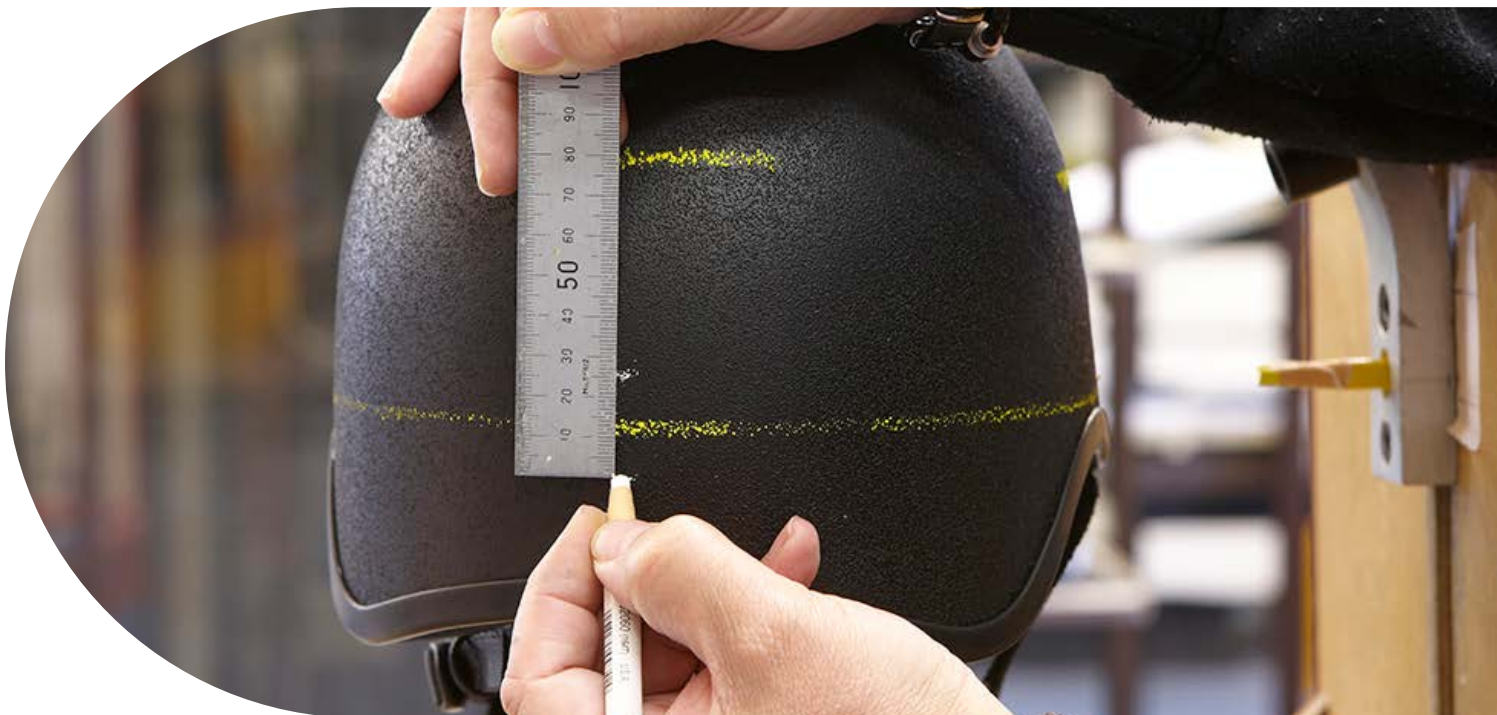
costs of PPE themselves, taking sickness leave or changing jobs due to embarrassment or lack of consideration for normal biological changes such as pregnancy and menopause.

Samantha Lushtak recalls when she was pregnant having to purchase three pairs of safety shoes. "My employer (at the time) had a policy which was to buy one pair annually unless they clearly needed to be replaced. Because my feet were growing and my body was changing so rapidly, I needed wider and wider shoes with more and more arch support, and ultimately needed something that would slip on instead of lace-up (an ergonomic concern). By the second pair of shoes, I was purchasing them for myself out of pocket to avoid the awkwardness of explaining what was going on to my facilities manager." Samantha was also in charge of her emergency response team and had to ban herself from taking part in the drills and responding to incidents because the level B suits got too hot to allow her to use them and her face was changing so much that she couldn't be confident in her self-contained breathing apparatus mask fit a few months after her fit test.

Here the internet has provided an effective solution. Employers which allow their workforce to source their own PPE (with guidelines on cost and requirements) can greatly increase the engagement and compliance of the workforce as the individual can take control of the sourcing of PPE that best fits them. Sourcing from countries with a better range, or even different industries – the equine industry has a good range of steel toe cap boots for instance, can be both practical and cost effective.



## More than just comfort



Fit is an essential component to the effectiveness of PPE. Fit will also have an impact on comfort and this in turn, will impact compliance levels. Any human – male or female, will be unhappy about wearing something that is uncomfortable. Worse still, ill-fitting equipment can increase safety risks and actually cause physical and even mental ill-health. Overalls, trousers, gloves which are too long or big can create tripping, entanglement, dexterity and contamination risks, as legs/sleeves are rolled, taped or even tied up: "I stuffed cotton in the fingers, put tape at the wrist, and tacked the top with staples to stop sparks from getting down the sleeve..."<sup>2</sup>

Ill-fitting and heavy boots, breathing apparatus and body protectors can give rise to acute and chronic musculoskeletal disorders. Poor fitting PPE can also be used as a source of bullying, harassment and intimidation. In 2016, in the UK, the trade union Prospect, Women in Science and Engineering (WSE), the Institution of Mechanical Engineers (IME) and the Trade Union Congress (TUC) conducted a survey exploring the issue of PPE for women. It found that not only did PPE hamper their work, create discomfort and injury but 28% of respondents reported that they had been subjected to derogatory comments as a result of ill-fitting PPE such as:

- 'You look like a kid playing dress up'
- 'Are you wearing your Dad's clothes'
- 'Here comes the elephant'

Heat stress is a well-known risk associated with PPE use, especially in hot and humid climates. For women this can be heightened as the monthly menstrual cycle increases core body temperature and can become even more serious during the menopause. The Prospect/WSE/IME/TUC report found that 21 per cent of women wore PPE during the menopause. Of

these, 38 per cent had curtailed their duties and 4 per cent had changed roles as a result of PPE issues.

Body protectors and stab vests can bring additional challenges. The 2017 TUC guidance document 'Personal Protective Equipment and women'<sup>4</sup> reported "In 1997 a women police officer was stabbed and killed while using a hydraulic ram to enter a flat. She had removed her body armour because it was too difficult to use the ram while wearing it. Two years later a woman police officer disclosed she had to have breast reduction surgery because of the health effects of wearing her body armour". Whilst stab vests may come with 'formed' panels for women's breasts, they take a 'one size fits all' approach, and other measurements such as torso length are not adapted. Furthermore, they don't take into account biological changes – breasts can become larger and more tender during the menstrual cycle and pregnancy - and finding a 'comfortable' vest after a mastectomy can be impossible.

The same TUC guide also reported on the Coastguard service's one piece overalls "they make it very inconvenient for female coastguards to use the toilet while wearing them. There is a double zip at the front which is great for males, but for female coastguards it is very impractical to go to the bathroom. It isn't just a matter of having to take off the overalls to use the bathroom. The overalls form a base layer over which several other pieces of PPE are often worn, such as foul weather clothing, life jackets, climbing harnesses etc. and it is a major operation to have to strip these all off in order to remove the overalls." Again, these challenges can be heightened during the menstrual cycle, pregnancy and menopause when there is often a need to visit the toilet more frequently to change sanitary wear or from pressure on the bladder.



## Empowering the workforce



For employers, PPE is at the bottom of the hierarchy of controls - the last option for protecting workers from health and safety risks. Therefore, the most effective solution to deal with PPE that does not meet the needs of a diverse workforce is to remove the need for PPE wherever possible. Where it isn't possible, it is the organizational culture and effective consultation and participation of the workforce

which removes obstacles and barriers, such as discrimination or embarrassment (real or perceived). These principles are clearly seen in the new global standard on health and safety management – ISO 45001. Organizations that implement this standard will empower their workforce to participate in good health and safety and in many cases the workforce will come up with effective solutions to PPE challenges.

Additionally, ISO 45001 has an emphasis on creating a health and safety management system which works for the worker – as opposed to simply working for the organization. It has a much greater emphasis on considering the individual and managing risks beyond just safety. It requires an organization to identify hazards such as social factors including workload, work hours, victimization, harassment and bullying.

The standard also requires organizations to consider human factors – how work is performed and designed; the needs and capability of the worker; and the culture of the organization. So a 'one size fits all' approach is inconsistent with good health and safety. Finally, with its focus on continual improvement, ISO 45001 also requires "that opportunities to adapt work, work organizations and work environments to workers" are assessed and implementing where possible.

## Conclusion

Increasing diversity is a factor which health and safety will have to take greater account of. Increasing participation of women in the workforce, an ageing population with its associated health needs plus growing ethnic diversity as a result of migration and birth rates means that responding to diversity is something all organizations will have to adapt to. In fact one study<sup>5</sup> estimated that there will be no ethnic or racial majority in the USA by 2042. 'Diversity' is more than this though. Different working patterns, for example shifts, the dependent self-employed (gig economy) or those with a portfolio career are all dimensions of diversity.

Human diversity should be seen in the same way as biodiversity in nature – as a positive source of exchange, innovation and creativity. We know that the most lush and productive regions of the world are the ones with the greatest biodiversity. It should therefore stand to reason that the most productive and flourishing organizations are those that successfully embrace diversity. Similarly we are moving to a society which champions protecting the environment and being responsible consumers of natural resources, so organizations should become custodians of their human resource.

However we need to understand the ecology of the system to ensure that we don't create imbalance. It is therefore important to understand the impact diversity has on occupational

health and safety. This is more than simply completing risk assessments for young workers or those with a mobility restriction. It needs to take into account differences in risk perception, attitudes to authority, time orientation, indirect communication, personal space, non-verbal communication, gender and even political history.

Organizational socialization – the process of conveying the organization's goals, norms, and preferred ways of doing things to its workers, or more simply 'identification with the organization' is therefore essential to managing diversity successfully. This does not mean pressuring workers to conform to a single norm but rather diversity as the norm. But how do organizations do this? Here there is no surprise; it starts with leadership and in particular transformational leadership. Developing capability in emotional intelligence across the organization is also important as this creates empathy and reduces conflict. The final element is 'inclusion' – involving and empowering workers.

Transformational leadership, emotional intelligence and worker inclusion – these are at the heart of good occupational health and safety, so embracing diversity for organizations with a proactive approach to health and safety should be a natural part of its ecology.

## About the author

---

Kate Field (CMIOSH) is BSI's Global Champion for occupational health and safety (OHS). Kate acts as expert and ambassador on OHS supporting the delivery of excellence and expertise across the 193 countries BSI operates in.

With a health and safety career spanning two decades, Kate has authored regulatory and technical guidance, written articles for a range of publications and is a successful global, keynote speaker and presenter.



## Acknowledgements

---

With thanks to the following for their contributions:

Andreea Vieru, Programme Manager, BSI Standards

Hilary Roberts, Global Head of Marketing, Product Certification, BSI Assurance

Ian Richardson, Standards Publishing Manager, BSI Standards

Nathan Shipley, PPE Group Certification Manager, Product Certification, BSI Assurance

Samantha Lushtak, Consultant, BSI EHS

<sup>1</sup> A Change Agent Project by the Ontario Women's Directorate and the Industrial Accident Prevention Association

<sup>2</sup> Toossi, M., & Morisi, T. L. (2017, July). Women In The Workforce Before, During, And After The Great Recession

<sup>3</sup> ILO Women in Work Trends in 2016

<sup>4</sup> <https://www.tuc.org.uk/research-analysis/reports/personal-protective-equipment-and-women>

<sup>5</sup> Johnson KM, Lichter DT. Growing diversity among America's children and youth: Spatial and temporal dimensions. *Population and Development Review*. 2010;36(1):151–176. doi:10.1111/j.1728-4457.2010.00322.x

## Why BSI?

---

BSI has been at the forefront of developing best practice for occupational health and safety since OHSAS 18001, the world renowned health and safety management system which was developed by BSI in 1999. More recently BSI proposed the development of ISO 45001 and has run the international secretariat supporting the project committee which developed the standard.

Working with over 84,000 clients across 193 countries, BSI is a truly international business with skills and experience across a number of sectors including automotive, aerospace, built environment, food, and healthcare. Through its expertise in Standards Development and Knowledge Solutions, Assurance and Professional Services, BSI improves business performance to help clients grow sustainably, manage risk and ultimately be more resilient.



## Our products and services

---

### Knowledge

The core of our business centres on the knowledge that we create and impart to our clients.

In the standards arena we continue to build our reputation as an expert body, bringing together experts from industry to shape standards at local, regional and international levels.

In fact, BSI originally created eight of the world's top 10 management system standards.

### Assurance

Independent assessment of the conformity of a process or product to a particular standard ensures that our clients perform to a high level of excellence. We train our clients in world-class implementation and auditing techniques to ensure they maximize the benefits of standards.

### Compliance

To experience real, long-term benefits, our clients need to ensure ongoing compliance to a regulation, market need or standard so that it becomes an embedded habit. We provide a range of services and differentiated management tools which help facilitate this process.

For more information on improving your organization's Health and wellbeing in the workplace practices, visit [bsigroup.com/en-ZA](https://bsigroup.com/en-ZA)