



ABurnet Limited

# Target Zero Hair Complaints

The White Paper on eliminating Hair Contamination before it becomes an issue.



This White Paper is intended to provide you:

- Scientific facts on hair shedding - how, why and when
- University research findings and ranking products based on hair containment
- The importance of clear, visual training tools and online auditing of staff compliance

#### *Source of Information*

**Professor Barry Stevens** FTTS, President of The Trichological Society 2014-16

**University of Bolton, UK - Professor Subhash Anand**, MBE, **Professor Subbiyan Rajendran** PhD; AIC; FICS; CText FTI & **Dr. Karthick Kanchi Govarthanam** PhD; MSc; B.Tech; CText ATI.

**Food industry specialists from across industry**

**ABurnet Limited**

# Executive Summary

## - Target Zero Hair Complaints

---

**Hair is currently a major contaminant of food and is a key measure of food quality. This White Paper is intended to give you expert knowledge from the President of The Trichological Society, together with University Research findings & expert food industry knowledge to help you select appropriate head coverings & best practices for your organisation.**

### **Why is hair a contaminate in the food we all eat?**

- The average human being sheds 40-130 hairs from the scalp per day at a constant rate. In an 8 hour shift this equates with 1,300 to 4,300 hairs per 100 people - Professor Barry Stevens FTTS, President of The Trichological Society 2014-16. - Page 9
- Modern hair styles and care practices involving heat and chemicals cause hair shafts to blister and sever increasing the probability of contamination, together with the shedding of beard, nasal and eyebrow hair. Relaxants and conditioners do not repair damage caused to hair. - Page 8
- Hair protrudes most when not lying flat explaining why the sides of the head have less hair protrusion. - Pages 12,13
- Short hair is twice as likely to protrude head coverings as longer hair and being less visible presents a much greater threat to food safety. - Page 16
- Abrasion of hair against standard head coverings forces hair through the fabric. Pages 17,28

### **Pathogens and hair – Pages 11, 23-24**

- Hair cannot be eliminated as disease carriers however hand contact with the scalp during food production is probably more likely to act as a carrier therefore a complete head hair covering is recommended - Professor Barry Stevens, President of The Trichological Society 2014-16.

### **How to contain shed and severed Hair**

- University of Bolton research - base 4,752 tests, President of The Trichological Society 2014-16 and Food Industry Professionals

- Extensive university research has proven that hair must be held flat with as many contact points along the hair shaft as possible.
- Wearers should be kept cool and comfortable to reduce fidgeting which both disturbs elastication and pushes hairs through standard fabrics – particularly those used in mob / bouffant caps.
- Bespoke head coverings HairTite and KleenCap have been developed with both HairBarrier and StayCool technologies to effectively contain hairs, validated by both University research (Page 17), qualitative feedback from the President of the Trichological Society 2014-16 (Pages 15, 20, 26) and food industry professionals. - Page 26
- Performance head coverings designed fit for purpose can be more cost effective than standard products - Page 27

### **Training**

- With many temporary and non-native speaking staff, training in best practice and correct wear guidance is essential. Training should be visual, rotated and relevant to audit findings. Complimentary posters and videos are available on line. - Page 30

### **Complimentary on-line auditing & KPI reporting**

- Compliance to best practice can be measured unobtrusively and efficiently using mobile devices (or forms) using on-line tools to pin point corrective actions. On-line graphics report best practice as a KPI for compliance evidence to customers. - Page 31

Read industry professional's positive feedback on both KleenCap and HairTite on pages 26, 20 and 15 with HairBarrier tools on page 31.

# Contents

---

<b>1.0</b>	Foreword	<b>5</b>
<b>2.0</b>	How to reduce Hair Contamination before it becomes an issue	<b>7</b>
<b>2.1</b>	How is Hair shed and why?	<b>7</b>
<b>2.1.2</b>	Hair Shedding and Damaged Hair	<b>8</b>
<b>2.2</b>	How can we Contain Shed Hairs, preventing contamination of Production?	<b>10</b>
<b>2.2.1</b>	Why Contain Hairs?	<b>10</b>
<b>2.2.2</b>	Pathogens and Hair	<b>11</b>
<b>2.2.3</b>	Where does Hair Protrude the most?	<b>12</b>
<b>2.2.4</b>	Why does Hair Protrude through Head Coverings?	<b>14</b>
<b>2.2.5</b>	How to effectively Contain Shed and Broken Hairs	<b>15</b>
<b>2.2.6</b>	Factors Important for Improving Hair Containment	<b>15</b>
<b>2.2.7</b>	Hair Containment of Different Head Coverings	<b>17</b>
<b>2.2.8</b>	Science of Hair Containment	<b>18</b>
<b>3.0</b>	Effective HairBarrier Technology	<b>19</b>
<b>3.1</b>	Head Coverings	<b>19</b>
<b>3.2</b>	HairTite HygieNets	<b>19</b>
<b>3.3</b>	HairBarrier Fabrics with StayCool and optional AntiMicrobial Technology	<b>21</b>
<b>4.0</b>	How does the Product Performance compare to costs?	<b>27</b>
<b>4.1</b>	Why do Shed Hairs Protrude Head Coverings?	<b>28</b>
<b>4.2</b>	Other Sources of Hair Contamination	<b>29</b>
<b>5.0</b>	How can we Train and Educate staff simply and effectively?	<b>30</b>
<b>6.0</b>	How can we easily monitor staff compliances to best practice and ensure relevant messages are communicated to staff effectively for continual improvement?	<b>31</b>

# 1.0

## Foreword

---

This White Paper is written based on:

- Extensive research by University of Bolton, UK
- Expert knowledge from trichology expert Professor Barry Stevens FTTS, President of the Trichological Society 2014-16 and
- Detailed discussion with food industry technical, quality and hygiene personnel from across industry by ABurnet over three years, the total research project costed £250,000, funded by a Knowledge Transfer Partnership from the Technology Strategy Board in the UK and ABurnet Ltd.

## About the Experts;

---

### **Professor Barry Stevens – Trichologist (FTTS, President of the Trichological Society 2014-16)**



Professor Barry Stevens MSc PhD (biochemistry) was awarded a Fellowship of the Trichological Society for ‘Outstanding Services to Hair Sciences – Worldwide (2000). Since 1967 he has practiced as a consultant in clinical and forensic trichology (Harley Street, London and Essex), a global lecturer in Trichological sciences and adviser to many organisations (cosmetic and pharmaceutical) including Which? Magazine, BBC Watchdog, Guinness Book of World Records, Phillips, Unilever, UK Trading Standards. He is an established expert witness to UK and overseas Courts of Law.

Clinical trichology is the diagnosis and treatment of diseases and disorders of the human hair and scalp.

Facts about trichology help us to understand the hair contamination issue.

# University of Bolton, England

**Professor Subhash Anand, MBE**, Professor of Technical Textiles, Institute for Materials Research and innovation, University of Bolton, England. Professor Anand lectures internationally on technical textiles, has led numerous technical developments leading to patented technologies and advises key retailers

**Professor Subbiyan Rajendran**, Professor of Biomedical Materials is technical and biomedical textile specialist with knowledge of chemistry as applied to technical textiles and has undertaken numerous developments leading to successful patented textile technology across numerous industries



*From left to right:*

**Dr S Rajendran PHd**; AIC; FICS; CText FTI

**Professor Subhash Anand** MBE - Professor of Technical Textiles; Comp Ti; CText FTI; BSc; MSc Tech; PhD

**Dr Karthick Kanchi** Govarthanam Ph.D; MSc; B.Tech; CText ATI

**Dr. Karthick Kanchi Govarthanam** has both worked in industry and completed his doctorate in technical textiles and has worked on many developments leading to patents in textile technology for a variety of industries.

**Food Industry Experts from all sectors** Food industry professionals from technical, quality and hygiene from convenience foods, meat processing, bakeries and confectionery, who have given us their expert knowledge, advice, time and support. ABurnet extend their grateful thanks to them all for sharing their knowledge and best practice.

From these experts and interviews with food industry technical and quality personnel we have produced this guidance booklet.

## 2.0

### How to Reduce Hair Contamination *before* it becomes an Issue

Working to eliminate hair contamination and prevent it from becoming a key business issue can be addressed by understanding these four key questions:



- 2.1** How is Hair shed and why?
- 2.2** How can we Contain Shed Hairs, preventing contamination of production?
- 2.3** How can we Train and Educate Staff simply and effectively?
- 2.4** How can we easily monitor staff compliance to best practice and ensure relevant messages are communicated to staff effectively for continual improvement?

## 2.1

### How is Hair Shed and why?

#### Hair Growth Cycle

- From the twentieth week of gestation a human foetal skin possesses 5.5 million hair follicles. Following birth many follicles engage in a continuing four-part cycle of hair-shaft production and loss
- The number of follicles on the human head varies by ethnicity but most Caucasian's will possess approx. 100,000 to 145,000 scalp hair-shafts at any given time
- Afro people tend to have a lower hair density per sq cm. Their hair-shafts are generally pheno-typically multi-helical and therefore vulnerable to damage and severance. Blond Germanic individuals may possess higher density fine hair-shafts per square cm of scalp
- Hair-shafts grow and are shed from their scalp follicles in four phases;
  1. Anagen (growth) accounting for between 80 - 90% of hairs
  2. Catagen (transitional) and
  3. Telogen (resting) where the epithelial tissue (triple layered structure) which connects the hair-shaft to its host follicle shrinks facilitating its evacuation
  4. Exogen

Continued...

- Rates of hair growth (anagen) vary by individual ranging from 0.018 cm - 0.040cm per 30 day month. Hair growth rates are directly equitable with their cross sectional diameter – the greater the diameter the faster its growth rate, and in many cases the greater the length achieved. Hair-shafts damaged by great age, weathering, chemical or thermal insult are vulnerable to severance at any point along their axes
- Terminal scalp hair-shafts usually have a life span of 2 to 7 years (some exceptions have been recorded)
- Eyebrow hairs and eyelashes have a life-span in the region of 4 months
- Beard hair grows more rapidly from the fourth decade

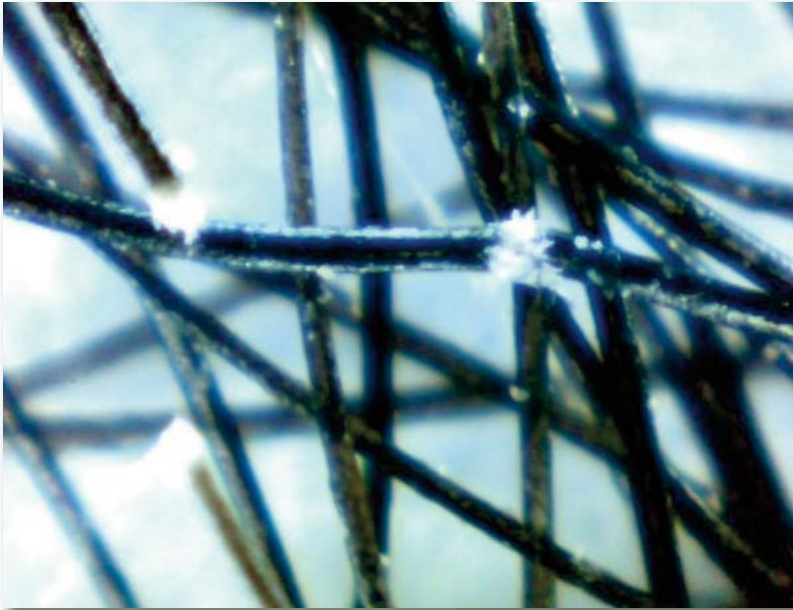
## 2.1.2

### Hair Shedding and Damaged Hair

---

- In Caucasoids an average of 40-130 hair-shafts will be lost to natural cyclical processes per day.
- Higher rates of hair shedding can be attributed to poor diet, reduced iron levels, post natal alopecia, fever or numerous other medical conditions.
- Hair damage is common - due to use of high temperature thermal appliances employed in hairdressing procedures.
- Chemical processes (e.g. colouring, permanent waving, relaxing or straightening) are potentially damaging by compromising the protein structure of the hair-shaft.
- Levels of such damage will be individually unique.
- Current conditioners do not repair hair-shaft damage but are useful in providing temporary improvement to lustre, feel, and drag reduction during routine grooming.
- The above processes compromise hair-shaft elasticity and tensile strength leading to such conditions as tricoptilosis (splits) or bubble hair syndrome (blisters) and/or trichorrhexis nodosa (node formation) with possible severance at some point along their axes.





**Trichorrhexis Nodosa Photo-micrograph x 50**

- Copyright B.J.Stevens

The high-spots indicate the points of eventual severance

It is the daily on-going shedding / severance of hair-shafts that will be found to contaminate food and therefore need to be effectively contained.

**Prof. Barry Stevens FTTS President of The Trichological Society 2014-16 adds:**

*“If we accept that hair-shaft shedding is a constant occurrence it is possible that 13-43 hairs could be shed from the scalp of each employee during an 8 hour period. This equates with 1,300-4,300 hairs per 100 people. These figures can be significantly augmented by thermal injury and severance (following exposure to excessive heat from hairdryers, curling tongs etc) and chemical insult e.g. bleaching, colouring, permanent waving, chemical relaxing or chemical straightening. The figures will be further increased by the daily losses of beard, nasal and ear hairs, eyebrows and eyelashes”.*

It is therefore no surprise that hair is potentially a significant contaminate of food.

By a combination of using headwear designed to contain hair comfortably with clear visual training guidance in best practice and simple on-line auditing tools with instant graphical reporting, leading food processors are reducing their hair contamination.

The following pages detail how.

## 2.2

### How can we effectively Contain Shed Hairs, preventing contamination of product?

---

Research by the University of Bolton, the world's first extensive valid research into hair containment are combined with the facts from Professor Barry Stevens FTTS, President of the Trichological Society 2014-16 and demonstrate that:

#### 2.2.1

##### Why Contain Hairs?

---

Whilst daily grooming will remove many of these shed and damaged loose hairs, the fact that:

- 1 Clearly not all shed and damaged 'loose' hairs are removed by personal grooming
- 2 Many hair styles are NOT brushed or combed but 'distressed' leaving the shed and damaged loose hairs on the head in addition to those shed during the work activity itself
- 3 Drying wet hair with high temperature settings on hair dryers and styling with curling tongs damages hair causing it to break off
- 4 Chemical treatments such as colouring, chemical straightening and perming damage hair causing it to weaken and frequently break off prematurely
- 5 Individual's habits vary greatly with some people showering before sleeping rather than just before work
- 6 Many people do not wash hair daily - and
- 7 Hair shedding is occurring all the time, including during the work shift itself.

Continued...

These shed and broken 'loose' hairs will be disturbed and potentially contaminate production during a working shift due to the following reasons:

- 1 The wearer scratching his / her head, the frequency of which can be increased where workers are hot due to either the ambient temperature, higher levels of work activity or discomfort from inappropriate head coverings themselves
- 2 General movement during the work activity
- 3 Whether standing or seated the head is usually tilted down towards the work activity increasing the exposure of shed or damaged hair from the crown due to gravity
- 4 The Abrasion of any head covering over hairs that are not lying flat.

## 2.2.2 Pathogens and Hair

---

**Prof. Barry Stevens FITS President of The Trichological Society  
2014-16 adds:**

*“Staphylococci / streptococci may present at sites of infection associated with e.g. impetigo, insect bites, minor trauma, eczema etc. Whilst it is known that the scalp can be a haven for bacteria (especially the relatively harmless Malassez Furfur (Pityrosporum Ovale).*

*I am unable to eliminate hair-shafts as disease carriers (i.e. Staphylococcus Aureus). However, hand contact with the scalp during food production is probably more likely to act as a carrier therefore complete head hair covering is recommended.*

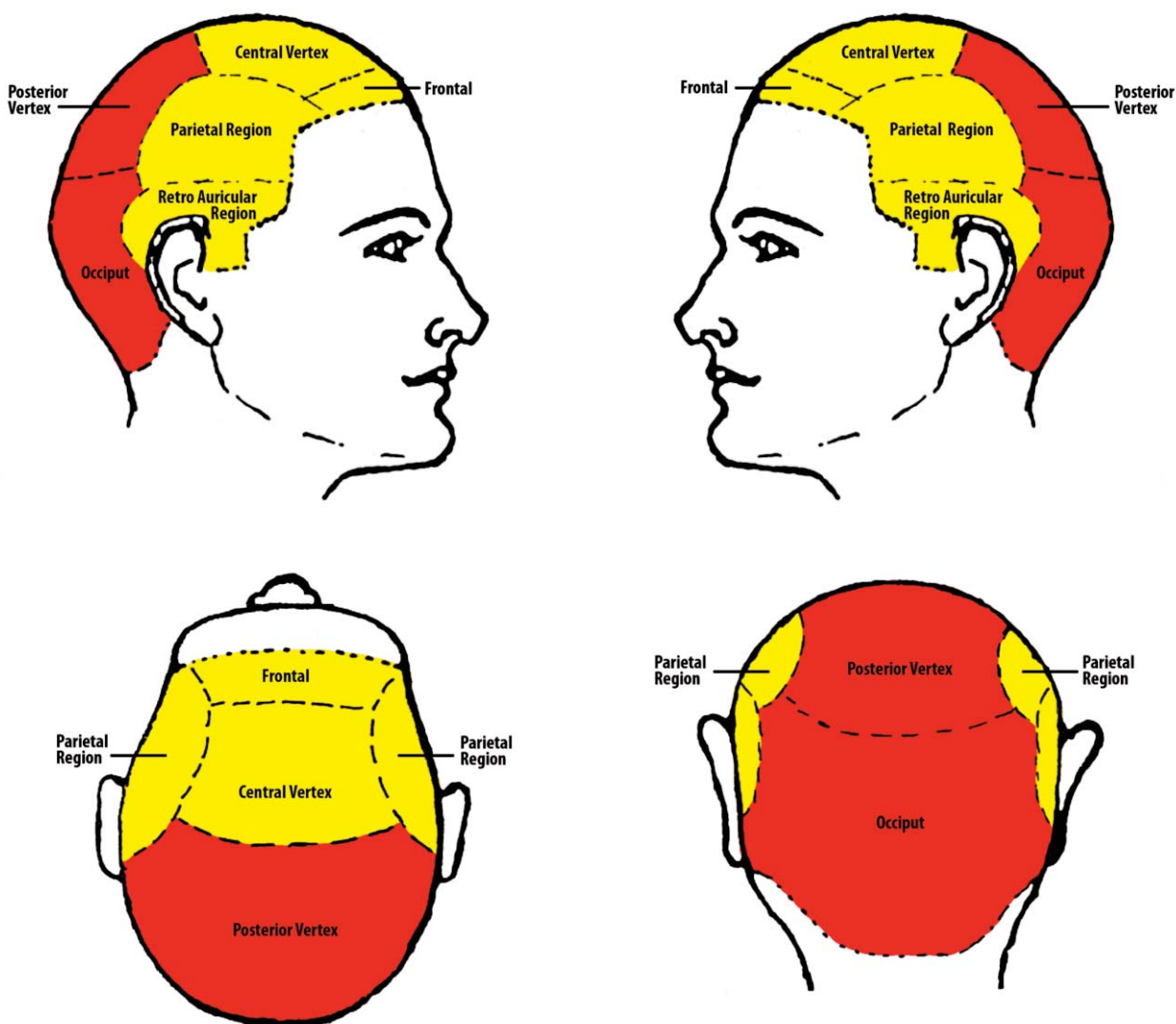
*I cannot ignore the potential for contamination via beard hair as this can be an involuntary target of touch by infrequently washed hands. Covering the beard with net is therefore a wise precaution”.*

## 2.2.3

### Where does Hair Protrude Most?

Due to the way in which hair lies on the head, areas where hair is lying flat were found to have significantly less hair protrusion than where hair lies more upright. Areas of the head where hairs protrude the most are detailed below:

Professor Barry Stevens is unable to comment on the table below as the angle at which hair-shafts emerge from their host follicles can vary significantly and was not present at the research study conducted by University of Bolton, UK.



Copyright B.J.Stevens

Location Of Head	Percentage of Total Hairs Protruding	Percentage of Head Area	Hair Protruding Density Factor
Posterior Vertex (Lower Crown)	17%	9%	1.9
Occiput (Rear/Nape)	16%	9%	1.8
Right Parietal Region (Right Side Upper)	12%	10.5%	1.1
Central Vertex (Upper Crown)	12%	20%	0.6
Left Parietal Region (Left Side Upper)	11%	10.5%	1.0
Left Retro Auricular Region (Left Side Lower)	11%	10.5%	1.0
Right Retro Auricular Region (Right Side Lower)	11%	10.5%	1.0
Frontal (Top Fringe)	10%	20%	0.5

From these results we can see:

- 45% of protruding hairs come from the Central Vertex(Upper Crown) and Parietal Regions (left and Right Upper Sides) , split:
  - o 10% of hairs are protruding from the Frontal (Top Fringe)
  - o 12% of hairs are protruding from the Central Vertex (Upper Crown)
  - o 23% of hairs protrude at the Parietal Regions (Left and Right upper Sides)
- 33% of protruding hairs come from the Posterior Vertex (Lower Crown) and Occiput (Rear/Nape). These hairs will potentially fall unseen onto the rear jacket collar and shoulders creating a high risk of contamination in food out of the general sight of the worker.
- Only 22% of hairs protrude from the Retro Auricular Region (Left and Right Side Lower) closest to the elastics. This is because in this area most hair is naturally lying flat and therefore better held.

**The key areas where the type of head covering is most critical to achieving high levels of hair containment are:**

- The crown (Posterior Vertex(Lower Crown), Central Vertex(Upper crown))
- Upper sides (Right Parietal Region, Left Parietal Region)
- Rear/nape (Occiput), not the lower sides edging where hair naturally lies flat (Right Retro Auricular Region, Left Retro Auricular Region).

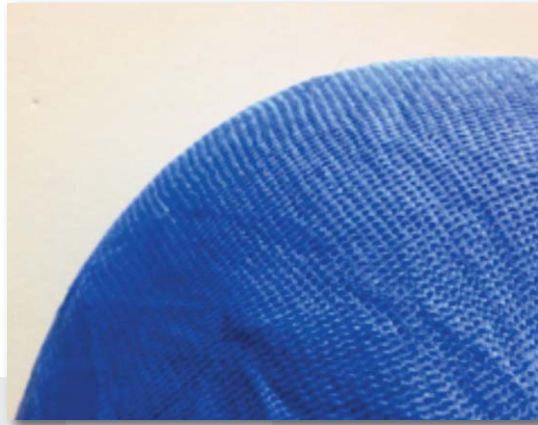
## 2.2.4

### Why Does Hair Protrude Through Head Coverings?

---



Hair protruding through 12gsm mob cap at Posterior Vertex (lower crown)



Hair not protruding through KleenCap Max at Posterior Vertex (lower crown)

Hair is forced up through fabric structures due to the following reasons:

- 1 Depending upon crown location, hair-shafts grow in a spiral configuration therefore those emanating from the central and anterior vertices will witness hair-growing forward and to the left or right. Any styling or loose fitting, open structures that force the hair against its natural growth pattern will permit the hair to protrude through the inherent gaps in the fabric
- 2 Abrasion of any head covering against the natural growth angle of hair such as when scratching the head will exacerbate this.
- 3 Hair being styled against its natural growth angle will also force more hairs through the fabric structure.

These facts were highlighted by the extensive University of Bolton study and support the test results where technical hair barrier structures out performed conventional fabric structures by a several time multiple as can be seen in the table on Page 17.

## 2.2.5

### How to Effectively Contain Shed and Broken Hairs

---

*“I am of opinion that the KleenCap-Max hairnets as supplied to me by ABurnet Ltd if carefully fitted to freshly washed hair and left untouched should be effective in containing shed and severed hair shafts” - Prof. Barry Stevens FTTS President of The Trichological Society 2014-16.*

**The University of Bolton** conducted extensive research into how to contain hair involving the largest ever study of different types of head coverings worn on ethically varied respondents. This involved 144 recorded wears per product or product combination worn, including a replication of scratching the head and was undertaken by a panel of 6 judges and independently observed. The research was conducted as per research protocols including:

- All products were worn to standard operating procedures with the whole process designed and regulated by the University
- A total of 4,752 separate tests were executed by the University to obtain some statistically valid results and a high coefficient of concordance
- Representative respondents from across gender, ethnicity, age, hair type, hair length, hair styles and head sizes were selected for the study.

International Food Hygiene magazine (Positive Action Publications) witnessed and photographed a section of the study.

This produced ‘The Science of Hair Containment’ which concluded:

## 2.2.6

### Factors Important for Improving Hair Containment

---

- 1 Hair needs to lie as flat as possible
- 2 Flat hair must be lightly held in place with as many contact points as possible along the hair shaft
- 3 Elastication is critical – to hold the head of hair at the all important edge whilst being comfortable to reduce the likelihood of fidgeting and hair disturbance

Continued...

- 4 The choice of material in the head covering is critical because:
- Hairs at 0.04-0.1mm diameter will be pushed up through the needle gaps in woven and knitted fabrics and more so in the inherent larger gaps in spun woven, spun bond, lace fabrics such as those used in mob caps which do **not** contain hairs effectively
  - Hair Styling often affects the natural growth angle of hair. Styling that holds hair flat, not upright is preferable as hair styled against its natural growth angle is more likely to protrude through head coverings
  - Short Hair is twice as likely to protrude through head coverings than longer hair. This is because short hair is much more likely to stand upright
  - Short Hair being less visible than long hair and protruding twice as much as longer hair poses a greater risk to food safety.
- 5 The wearer should be kept cool and comfortable to reduce the likelihood of fidgeting disturbing the head covering.



## 2.2.7

### Hair Containment of Different Head Coverings

The below table of results from the University of Bolton Research is the average number of protruding hairs per person, per wear following 144 recorded wears per product combination.

Head Covering(s)		University of Bolton Findings				Additional Hair Containment Technology			Optional AntiMicrobial Technology	
Under	Outer	Actual avg. qty. protruding hairs per use	Factored avg. qty. protruding hairs per use*	Hair containment improvement factor	Short hair protruding over long hair multiplier	HairTite Technology	hairBarrier Technology	staycool Technology	HairTite	KleenCap
None	12 GSM Mob Cap	74*	85	0.0	2.3	X	X	X	X	X
None	KleenCap Standard	35	35	2.4	2.0	X	✓	X	X	X
HairTite Standard	12 GSM Mob Cap	21	21	4.0	1.6	✓	X	X	✓	X
HairTite Standard	KleenCap Standard	20	20	4.3	1.7	✓	✓	X	✓	X
HairTite HiCare	12 GSM Mob Cap	15	15	5.7	1.8	✓✓	X	X	✓	X
HairTite HiCare	KleenCap Standard	15	15	5.7	1.7	✓✓	✓	X	✓	X
HairTite Standard	KleenCap Max	11	11	7.7	1.6	✓	✓✓	✓	✓	✓
HairTite HiCare	KleenCap Max	8	8	10.6	1.6	✓✓	✓✓	✓	✓	✓

\*Note: Where MobCaps balloned away from the head, protruding hairs could not be accurately counted. The University therefor factored the figure to account for the percentage of the head zones where the MobCap balloned away from the head.

**Professor Barry Stevens FITS, President of the Trichological society 2014-16 reviewed these findings and concluded:**

*"I have served 50 years as a clinical and research trichologist, international lecturer and international expert witness, I believe my contribution herein represents a brief but realistic overview of human hair-shafts, their directional growth patterns and shedding characteristics. As I was not involved in other aspects of research leading to the creation of the complete document I am unable to comment on them."*

## 2.2.8 Science of Hair Containment

# The Science of Hair Containment

## HairTite

- Unique 'Fold and Hold' technology helps to contain hair, especially important for short hair
- Numerous contact points holding hair flat along each individual shaft
- Excellent for encasing long hair
- Expands and contracts to hold both short and long hair

- **Folds hairs flat**
- **Holds with high-density structure**

PATENT PENDING DESIGN



HairTite

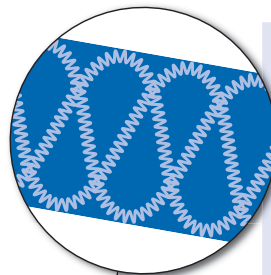
## KleenCap

with *staycool* option

contains **hairBarrier**  
TECHNOLOGY

PATENT PENDING

- Expandable fabric to provide high-surface contact with head
- Provides a (+) positive attraction to help hold and retain shed hair
- Intelligent, non-slip structure to help keep hair firmly in place



KleenCap  
over HairTite

Wear KleenCap over HairTite  
for optimum hair containment

## 3.0

### Effective HairBarrier Technology

hairBarrier

To effectively contain hair it is necessary to assess:

1. Product, process and risk level
2. Movement between different risk areas for staff including management, hygiene, first aid and maintenance
3. Ambient temperature
4. Levels of work activity – do they vary during a work shift? Do workers move from hot to cold and vice versa?
5. Special requirements eg: process plant, ethnicity or religious head coverings.

## 3.1

### Head Coverings

Developed for and independently performance tested by the University of Bolton, bespoke hair barrier technology products include:

## 3.2

### HairTite HygieNets & Beard Nets

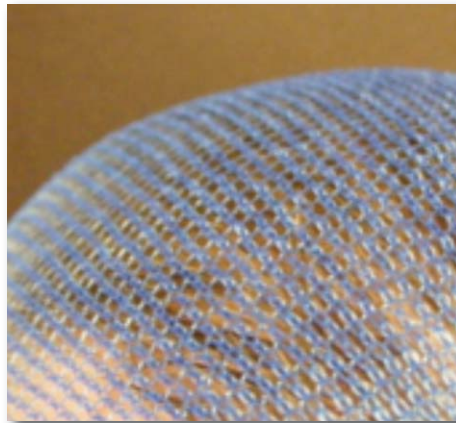
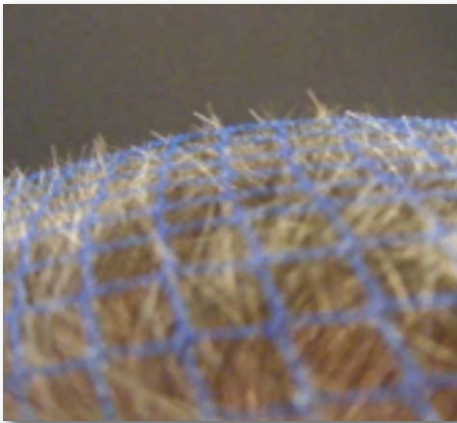
hairtite

Patent pending structure utilising Stretch-to-fit technology to lightly hold and grip the head of hair with more contact points than a traditional diamond shaped mesh hairnet of the same weight and cost whilst maintaining air flow for natural self thermoregulation.

Continued...

Independently tested for 2X hair containment over a diamond shaped mesh hairnet for the same cost, namely;

- HairTite Standard over 5mm diamond shaped mesh
- HairTite Hi-Care over 3mm diamond shaped mesh



Photographs courtesy of  
International Food Hygiene  
magazine

Select the most appropriate variant for your needs - all featuring Prolen® yarn that promotes wicking and does not absorb sweat affording comfort to the wearer.

All HairTite HygieNets & Beard Nets are available with **AntiMICROBIAL** silver ions technology to special order.

Note: ABurnet Ltd only recommends this technology in complete head coverings such as Breathable HairBarrier KleenCap Max and Neck Shield as this helps prevent the wearer having contact with the scalp and being a cross vector of pathogens if worn correctly.

### **What Professor Barry Stevens FTTS, Trichologist and President of Trichological Society 2014-16 says:**

*“Food production personnel can effectively prevent scalp hair contamination through the wearing of HairTite HygieNets and KleenCap-Max, with HairBarrier products such as Neck Shield – which can be worn in multiple ways to cover beard, face and nasal hair as desired, or Beard Shield, or KleenCap-Max Neck Guard (covering scalp and beard hair) if new each day or cleansed with HairGon after a single day’s wear to remove any residual hair-shafts caught in the material. However eyebrow, eyelid, ear and facial hair cannot be ignored - their prevention being more problematic”.*

### 3.3 HairBarrier Fabrics with StayCool and optional AntiMicrobial Technology

hairBarrier  
staycool  
AntiMICROBIAL

Breathable fabrics used in KleenCaps, Beard Shields, Neck Shields, Arm Shields and KleenCap Neck Guard feature the three technologies of HairBarrier, StayCool and optional AntiMicrobial.



#### 3.1.2.1 HairBarrier Technology

hairBarrier

- Light hold recoiling fabric structure to hold the head of hair in a comfortable way
- Positive attraction to the keratin protein found in hair
- Intelligent non-slip structure helps keep hair in place
- Uniform gripping action to help hold any protruding hairs in place.



- 12gsm mob cap
- Inherent gaps in material easily allow hair to protrude

- KleenCap Breathable HairBarrier fabric restricts hair penetration
- StayCool Technology transports moisture through the fabric to evaporate into the atmosphere to help keep workers cool
- AntiMicrobial inhibits the multiplication of bacteria and fungi such as Gram positive Staphylococcus.

## 3.1.2.2 StayCool Technology



In humans, sweating is primarily a means of thermoregulation which is achieved by the water-rich secretion of the eccrine glands.

Simply stated, when sweat evaporates from skin, it carries heat away with it and naturally cools the skin.

To allow the evaporate cooling process, surface moisture must travel through the HairBarrier fabric and evaporate to atmosphere keeping the head cool and dry.

Using the same technology as performance sportswear, channelled yarns placed through the depth of HairBarrier Fabric transport the moisture away from the skin through the fabric and allow it to evaporate to atmosphere.

Compared to other fabrics, StayCool products will be:

- More breathable- uniquely engineered so that sweat absorption and diffusion is perfectly channelled through the spaces embodied within the HairBarrier with Staycool fabrics
- More comfortable to wear. Prevents soggy feeling by keeping your skin dry and cool, allowing you to feel fresh and less fatigued
- Hot environments - helps keep workers cool where performing higher levels of physical activity
- Cold environments Helps keep workers warmer due to the thermal pockets created by the micro-channels.



The average adult loses .07L of water per day through sweat but depending on heat or exercise intensity, can lose as much as 2.5L each day.\*

\*Information Source: DRYMAXSOCKS

## Wicking Tests: Mob Cap V KleenCap and KleenCap-Max- University Of Bolton

**How effective is StayCool Technology?** - the effectiveness of StayCool technology is demonstrated by wicking properties.

	Mob Cap	KleenCap Standard	KleenCap-Max with StayCool
Wicking Length (mm)	2	8	45
Wicking (g/cm)	-	0.07	0.10
Gram per gram	3.11	5.46	9.09

**Wicking Length** is the length up to which the water is absorbed against the gravity when the fabric is immersed by 1 cm into the water for 6 minutes.

**Wicking (g/cm)** is the amount of water has been wicked per centimetre in grams. A value of 0.1 means that the fabric will wick 0.1 gram of water per centimetre.

**Gram/gram** is the amount of water that has been retained by one gram of the fabric. A value of 9.09 means that one gram of the fabric will retain 9.09 grams of water.

**Conclusion: gram per gram KleenCap Max with StayCool Technology Wicks:**

- **3 X more weight of moisture than a MobCap**
- **22 X more length of moisture than a MobCap**

### 3.1.2.3

#### AntiMicrobial Technology

**AntiMICROBIAL**

- AntiMicrobial Silver ions are known to inhibit the growth of bacteria and fungi including the pathogen Staphylococcus aureus which is commonly found on human skin and particularly the scalp. Because of their potent antimicrobial properties, the presence of silver ions in hygiene-sensitive products may reduce the risk of bacterial and fungal infections. Silver ion technology is incorporated into garments by adding the silver to the polymer yarn or by coating the finished yarn with silver. Additional protection is offered by coating the whole finished product with AntiMicrobial Technology as with KleenCap Max.

Continued...

- For this reason people with little or no hair are advised to wear a complete fabric head covering to limit the possibility of the food handler being a cross vector of pathogens found on the scalp. A complete fabric hair covering that features AntiMicrobial technology is advisable.

Any mesh structure is ineffective at preventing direct fingertip contact as the soft skin of the fingertip moulds itself through the mesh structure making direct contact with the scalp.

- AntiMicrobial silver ions also:
  - Reduce both stains and odours
  - Help extend the product life
- The use of AntiMicrobial silver ions is known to be harmless for man and the environment
- All breathable KleenCap-Max and HairBarrier products have AntiMicrobial silver bio-genic ions technology.

### Independent Test Results

KleenCap Max with AntiMicrobial Technology has been formulated with silver ions over the complete product, including elastication to be effective at inhibiting the multiplication of Gram positive and Gram negative bacteria over 15 washes with HairGon as the following table of results prove:

Test Method	Test Strain	
Method ASTM E2149: Standard Test Method for Determining the Antimicrobial Activity of Antimicrobial Agents Under Dynamic Contact Conditions	Escherichia coli (E.coli) and Staphylococcus aureus (methicillin resistant strain)	
No wash	MRSA	>99.9%
	E.coli	>99.9%
5 washes with HairGon Formulation	MRSA	Void
	E.coli	>99.9%
10 washes with HairGon Formulation	MRSA	99.20%
	E.coli	Void
15 washes with HairGon Formulation	MRSA	>99.9%
	E.coli	>99.9%

When considering products with AntiMicrobial treatment, ensure the product has been tested as fit for purpose. Any lower concentrations of the silver ions may prove ineffective.

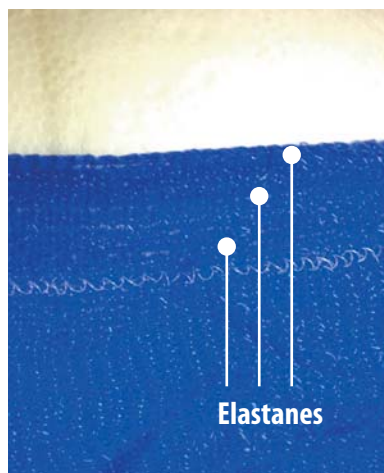
Note: Void = Technical error during testing

All laboratory tests were undertaken by one of Europe's leading antimicrobial technology solution providers to ISO standards.



**Lab Control** Non antibacterial comparable (non woven) material

**Bacteria Content** Chemically bonded, antimicrobial agents are not free to diffuse into their environment under normal conditions of use. This test method ensures good contact between the bacteria and the treated fibre, fabric, or other substrate, by constant agitation of the test specimen in a challenge suspension during the test period..



### 3.1.2.4 Elastication Comfort

To ensure maximum protection all elasticated products are manufactured to set quality standards and tested for:

- **Stretch Resistance**
- **Original Power**
- **Recovery Power**

For increased comfort and performance all KleenCaps incorporate a uniquely engineered integral latex free triple spaced elasticsation, to achieve both hair line security and shift-long wearer comfort.

Industry wearers widely report breathable KleenCap-Max as cooler, more comfortable and better looking to wear than a mob cap.

If you require a trial sample contact ABurnet:

[Click Here](#)

Read the Professional's comments overleaf...

**What Professor Barry Stevens FTTS, Trichologist and President of The Trichological Society 2014-16 says:**

*“KleenCaps look good; the cap lightly holds the hair and I cannot envisage any hair escaping through the fabric structure. The triple elastic distributes pressure evenly whilst ensuring hair line safety. I understand the StayCool technology is proven to wick moisture away from the head and may regulate the wearer’s temperature”.*

**Read typical food industry feedback:**

*“We have trialled Kleen Cap and the feedback from the operatives is that the KleenCap is very comfortable”.*

**Michaela Watson, QA/Compliance Manager, Freshtime UK Ltd, England.**

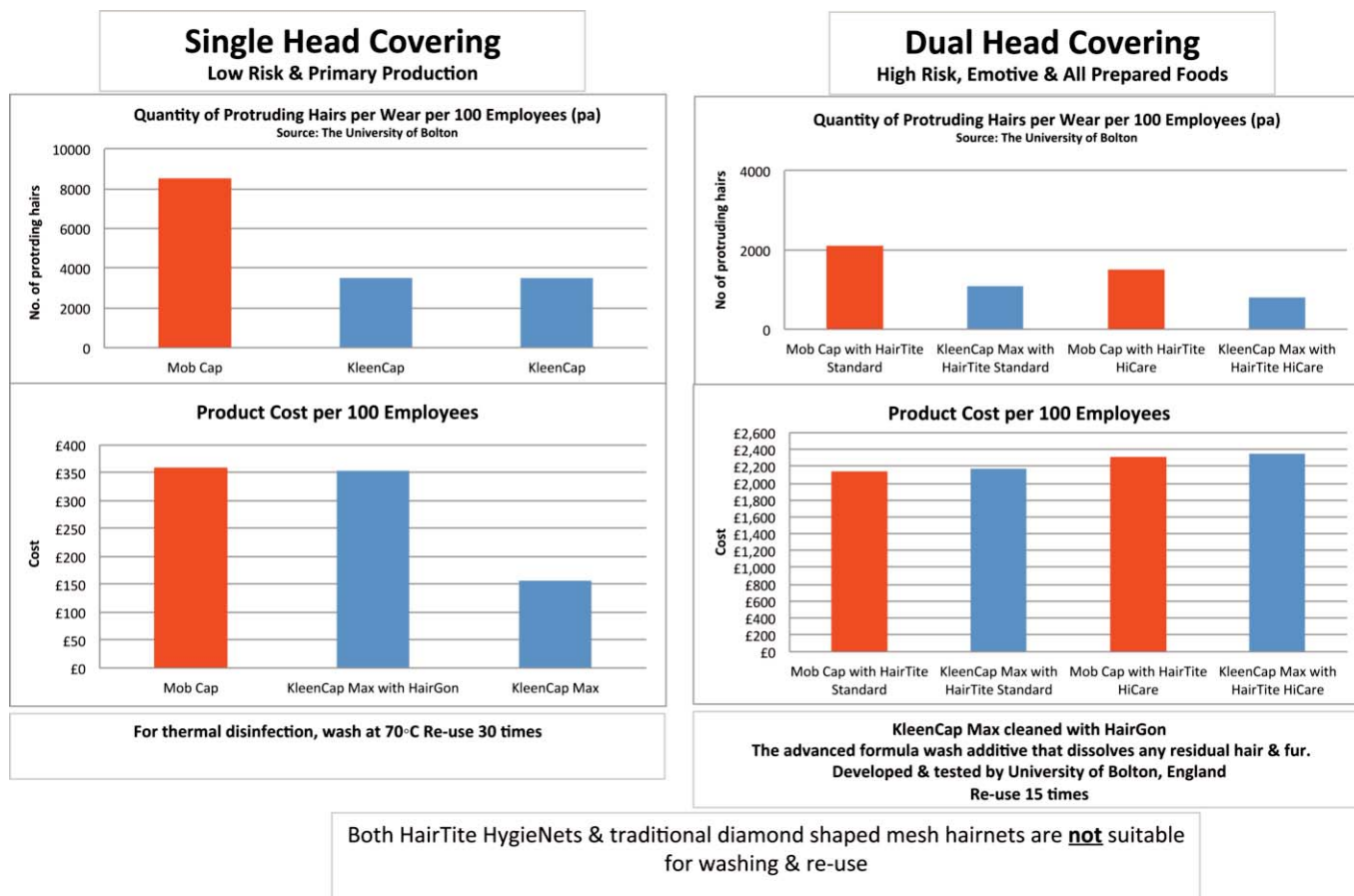
*“This is a really innovative approach to hair containment and complaint reduction. A choice of hair coverings which are well supported with clear visual aids and a KPI Management system to track improvements by area. A one-stop shop!”*

**Ann Marie Helmn, Technical Manager, Fox’s Biscuits Batley  
2 Sisters Food Group**

## 4.0

## How does the Product Performance Compare to Costs?

The table below shows the hair protrusion per 100 employees compared to the expected cost from an appointed distributor:



KleenCaps can be washed at 70 degrees for thermal disinfection and re used 30 times to make them both better performing and lower cost than a mob cap. For maximum hair containment, use HairTite HygieNets underneath KleenCap Max and wash and reuse KleenCap Max in HairGon, the advanced formula wash additive that dissolves residual hairs in the wash, 15 times.

The easy to use wash bag system with colour coding by date rotation with optional process control validation makes reusing performance HairBarrier products both easy and cost effective.

## 4.1

### Why Do Shed Hairs Protrude Head coverings?

---

Hair at 0.04-0.1mm diameter is significantly thinner than the needle gaps in fabrics - particularly gaps found in non-woven fabrics such as those used in mob caps.

University of Bolton research found that hair is pushed through all fabrics due to:

- Abrasion of any head covering over the head of hair
- Short Hairs will protrude 2 x more than longer hairs
- Hair Styles that do not allow hairs to lie flat will protrude more
- Agitation – it is a human fact that we all touch our heads frequently during the day, such as when thinking or scratching our head. This can increase due to discomfort.
- Area of Head – hair is more likely to protrude from the crown and rear where it does not naturally lie flat; not from the lower side edges.

It is therefore critical to use head coverings designed to contain shed and damaged hair that is detached from the scalp, loose in the hair.

Contact us here for your trial samples:

[Click Here](#)

## 4.2 Other Sources of Hair Contamination

Hair contamination can come from other areas of the body such as:

- Neck
- Arms
- Hands
- Eyebrows
- Nasal hair
- Ears

**hairBarrier** free guidance tools

### Sources of hair contamination - and how to solve them

**Fringe**  
Ensure head coverings are worn correctly - download FREE wear and hygiene guides at [www.aburnet.co.uk/free-tools](http://www.aburnet.co.uk/free-tools)

**Short Hair**  
Research found that short hair is 2X more likely to protrude through head coverings than long hair. Read the research findings at [www.aburnet.co.uk/increase-hair-containment](http://www.aburnet.co.uk/increase-hair-containment) to find out why and how to control it.

**Neck Hair**  
Consider KleenCap NeckGuard and new NeckShield - designed in response to industry requests to cover neck hair - see [www.aburnet.co.uk/products/hairnets-food-industry](http://www.aburnet.co.uk/products/hairnets-food-industry) for more info.

**Ears**  
Ensure head coverings incorporate HairBarrier fabrics designed to contain shed hair and that head coverings are both sized and worn to cover the ears. Use Aburnet's FREE audit tools and wear and hygiene guides to help train staff and quickly monitor their adherence to your policies.

**Arms**  
Contain arm hair by using shields appropriate for the work task. Workers often complain that plastic covers are hot to wear. Due to requests we are currently producing a trial quantity of arm covers in our HairBarrier and StayCool technology fabric. HairGen compatible these Arm Shields are more comfortable than plastic next to the skin. Contact us now to reserve your trial. [www.aburnet.co.uk/contact](http://www.aburnet.co.uk/contact)

**Crown**  
Ensure effective coverings are used which are both designed and independently performance tested to contain hair such as HairTite HygieneTies, KleenCaps, NeckShields and Beard Covers - read the independent test findings at [www.aburnet.co.uk/increase-hair-containment](http://www.aburnet.co.uk/increase-hair-containment)

**Eyebrows**  
The most difficult area to contain as any covering is likely to be both uncomfortable and reduce vision causing both staff and health and safety issues. Use Aburnet's FREE HairBarrier tools GMP advice to ensure all staff have a good level of personal hygiene and quickly monitor this with the FREE on-line Audit tools with graphical reporting.

**Nasal Hair**  
Register on the Aburnet website to review HairBarrier tools GMP advice on personal hygiene [www.aburnet.co.uk/free-tools](http://www.aburnet.co.uk/free-tools) to ensure best practice is incorporated into staff handbooks, contracts of employment and agency agreements. Consider use of Aburnet's Beard Mask and Neck Shield incorporating HairBarrier and StayCool technologies which can be worn over the nose to safeguard food quality.

**Nape**  
In addition to using Aburnet's FREE wear and hygiene guides, check your product's elasticity is both strong enough to encase and hold longer hair.

**Long Hair**  
Long hair has been found to tear mob cap material and drag head coverings away from the nape if not contained properly. Use Aburnet's Blue HairTite HairTies and Bun Nets with super strong elasticity to effectively tie and hold long hair in a bun making the head covering effective. Available in both metal-free and, same cost, ferrous metal detectable for your due diligence.

For further information contact  
Aburnet Limited, Walter Street, Draycott, Derbyshire DE72 3NU UK  
Tel: 01332 874797 [info@aburnet.co.uk](mailto:info@aburnet.co.uk) [www.aburnet.co.uk](http://www.aburnet.co.uk)

**aburnet**

For more information on how to limit the contamination risk from these sources:

[Click Here](#)

## 5.0

### How can we Train and Educate Staff simply and effectively?

Staff need to comply to your best practice policies but with many temporary and non English speaking workers, clear, quick, visual training is essential.

Make constant training and education simple and

Click link below for your Downloads (requires simple registration)

Download for FREE:

- 2.5** How to Wear guides - Visual and multi-lingual
- 2.6** Best Practice Guides such as Buddy Up and Enclose All Your Hair - Visual and multi-lingual -
- 2.7** FREE training video – both canteen loop play and Q&A with optional staff training certificate
- 2.8** Best practice guidance – qualified help through rigorous industry research and analysis - cross check your own policy



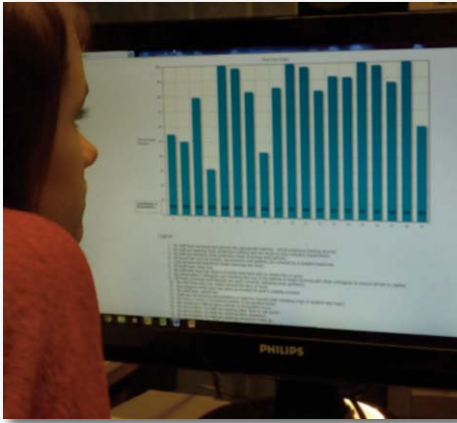
Request your agency pre-train staff using the above free tools.

For your FREE downloads:

[Click Here](#)

## 6.0

How can we easily monitor staff compliance to best practice and ensure relevant messages are communicated to staff effectively for continual improvement?



- FREE on-line audit tool allows you to audit compliance to best practice quickly and easily
- Your data is stored and is confidential to your account only. It can be summarised to your requirement at a few clicks of your mouse to report a KPI based on line, department, site or function as you desire
- Report and demonstrate staff compliance to best practice as a 10 minute per month KPI
- Rotate key messages such as best practice posters regularly to keep staff guidance relevant and 'top of mind'.

For your FREE Audit tools and GMP guidance:

[Click Here](#)

### Free Audit Tools

*"The Free audit tools are great to use as it makes audits easy and you can soon find out where the issues are, the reports are great to show the customer to demonstrate that you are being proactive"*

**Michaela Watson, QA/Compliance Manager  
Freshtime UK Ltd, England**

## Information Source

For further help and advice, please contact:

Janet Faulkner	janetf@aburnet.co.uk – Enquiries & Sales Administration
Rob Singh	robs@aburnet.co.uk – Sales enquiries
Richard Burnet	richardb@aburnet.co.uk – Managing Director
Louise McKettrick	louisem@aburnet.co.uk – Web Based Tools
Paul Parsons	paulp@aburnert.co.uk - Technical Developments

E:info@aburnet.co.uk    T:+44(0)1332-874797    F: +44(0)1332-875284

### **ABurnet Limited**

Walter Street, Draycott  
Derbyshire  
DE72 3NU  
England

Registered number 202702.

Quality since 1898

### Disclaimer

Copyright© ABurnet Ltd UK, The University of Bolton, and Professor Barry Stevens FTTS, December 2014.

You are welcome to share this document and to use the information it contains to benefit your business. However, please note that you must not sell copies of the document, pass yourself off as its author, or use it (or any part of it) to compete commercially with any of the copyright owners.

The document is for information purposes only and the copyright owners do not give any warranties about the accuracy or completeness of its contents.