Selection, Use and Maintenance of Chemical Protective Clothing

Mark B. Simpson
• Manufacturer of specialist chemical and respiratory protective clothing - reusable & limited use mainly to Type 1-4 & Type 7.
• UKAS accredited chemical permeation laboratory testing to BSEN369 and ASTM 739
• SERVICETECH - Mobile equipment maintenance & testing service
• TRAININGTECH - onsite training to ensure all employees can effectively use PPE
• AIRTECH Air-Quality testing to EN1342 (BS4275)
The Wider Picture

The use of chemical protective clothing should only be considered after all other exposure mitigation measures have been considered and reasonable effort has been made to implement them.
Regulatory diversity

• Different items of PPE are covered by different regulations

• Specific regulations cover, for example, operations involving lead and asbestos
Risk Assessment

• Understand the potential hazard
• Assess the likelihood
• Evaluate the risk
The need for PPE

• Based on, and as a consequence of, a thorough Risk Assessment
• Only as a considered response
• Not a knee-jerk reaction.
Appropriate PPE

- Materials
- Design
- Construction
- Testing
E.G. The Hazards of Heat Stress

As an example of appropriate selection let us look at heat stress prevention

Heat stress can arise in many different scenarios:

1. Inside a Gas Tight suit
2. In proximity to a heat source (A fire)
3. In an industrial area (Foundry)
4. Effect of natural rise in Temperature (Heat-wave)
Mechanism of Cooling the Body

- Excess body heat
- Sweating
- Use of excess body heat to evaporate sweat

*PROBLEM.*

If the ambient air is saturated with water vapour the sweat will not evaporate.
Problems inside P.P.E.

- Most P.P.E. is water impermeable to some degree.
- Humidity inside the P.P.E. rises rapidly.
- Exhaled air in encapsulated P.P.E. has a high humidity.
- The body will continue to sweat but as the sweat will now not evaporate.

- There is therefore now no cooling effect.
Magnitude of Heat

- Heat is generated by muscle activity
- Muscle activity is only 20% efficient
- What happens to the other 80%?
- Body generates approx 80 watts of heat at rest
- It can generate more than 500 watts when working
Existing Solutions

GTBV i.e a Gas tight suit fitted with air-cooling tubes.

PROBLEMS

• Rapid depletion of air bottle
• Cooling effect minimal
• Adds expense to the suit
• Integral to suit
Vortex Cooler:

Works by separating warm and cold air molecules. Cold to suit warm rejected.

PROBLEMS.

• Needs large amounts of compressed air to work.
• Only practical for suits supplied with compressed air from an outside air-line
Existing Solutions

Evaporative Cooling

i.e. Various scarves, vest etc that rely on being soaked in water.

As the cooling is effected by the water evaporating we are back to the same problems as sweating. It won’t work under P.P.E.
Existing Solutions

Ice Vests

Cooling garments with pouches of frozen water inserted.

Problems:

• Too cold
• Peripheral blood circulation closes down
• No transfer of cooling effect to the body core
• Can actually cause the body core to over-heat.
• Uncomfortable (chills skin area)
Paradoxical but:

The requirement is to take heat away from the body without chilling skin.
Kool Packs

• Works on the latent heat of fusion of the material inside the KOOL Pack.

• As the contents melt they remove heat from the body.

• As the melting point is around 18º C the body will not be chilled.

• The peripheral blood circulation continues allowing the cooling effect to be transferred to the bodycore.

• It allows the body to feel “normal” not cold whilst actually removing heat.
The Respirex KoolVest

- New innovative product
- Light, comfortable 1 size fits all
- Colour coded fastening straps.
- Proban outer shell
- Preshrunk cotton liner pockets.
- Thinsulate insulation- to allow garment to cool wearer not environment.
- Cools not chills. i.e. It works!
Pack regeneration

• Packs can be regenerated time after time
• Just a matter of taking the absorbed heat out of the pack
• The lower the temperature the faster the regeneration
• But as long as the environment is below 18 C the packs will regenerate provided that there is somewhere for the heat to go.
• Will regenerate in 25 minutes in a bucket of ice water
• Just one example of apply a selection process to seek appropriate P.P.E.

• We identify the problem, eliminated the non viable & found a solution

• The same can apply to all types of P.P.E. not just the KoolVest.
Manufacturers of Personal Protective and Respiratory Protective Equipment