

Actively fighting heat stress – Teijin Active Cooling Vest

TEIJIN

Dr. Christian Norhausen
Teijin Smart Safety

Teijin Smart Safety – Who we are

- A team of experts from the Japanese Teijin Group that develops and commercializes active and intelligent safety solutions, helping to improve the personal health and safety of front-line professionals.
- Lean approach with Start-Up mentality, working closely with universities, semi-governmental, public and private institutions but most importantly end-users to help to achieve common goals.
- Focus areas are firefighter, police, military, ambulance services, industry.
- We for example work on:
 - Active Cooling
 - Indoor Tracking
 - Intuitive Navigation
 - Clean FF Suits
 - Safe working
 - ...
- Located in Arnhem the Netherlands at Teijins subsidiary Teijin Aramid BV.



More information on
www.teijinsmartsafety.com

<https://youtu.be/Qhd2241RAk0>

1

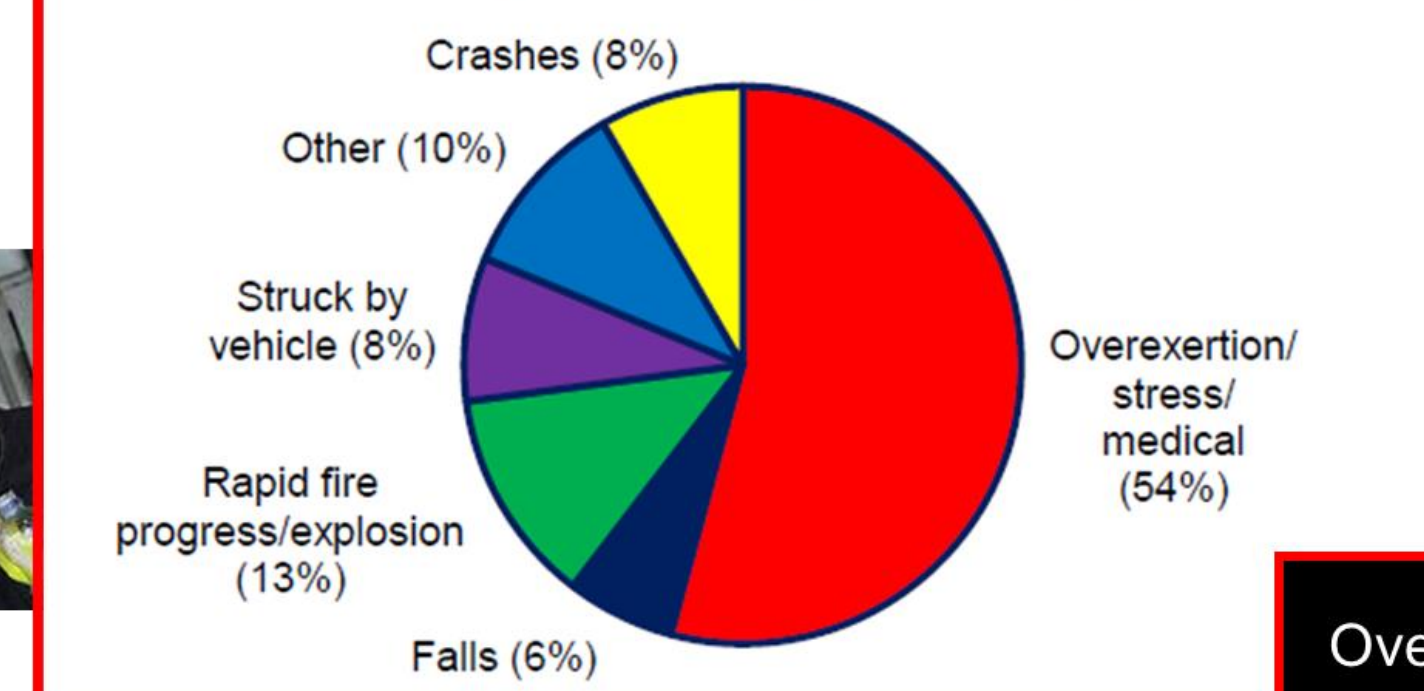
Heat-stress & Consequences

Wearing PPE can increase the risk for heat-related illnesses

- Reduces concentration and increases tiredness
- Leads to lower working and cognitive performance
- Persisting heat-stress increases the recovery time
- Can result in heat illness or life-threatening heat stroke



Figure 3. Firefighter Deaths by Cause of Injury – 2019



Source: Rita F. Fahy, Jay T. Petrillo, Joseph L. Molis, "Firefighter Fatalities in the United States - 2019" NFPA Report, Issued July 2020

Overexertion/stress/medical leading cause of death making up 54% of all on-duty deaths in 2019

2

Body Cooling possibilities

Different principles used

Water evaporation vests



Phase Change Material vests



Liquid cooling system vests



Air blow vest



Actual wearable personal cooling systems have limitations within a work setting, such as:

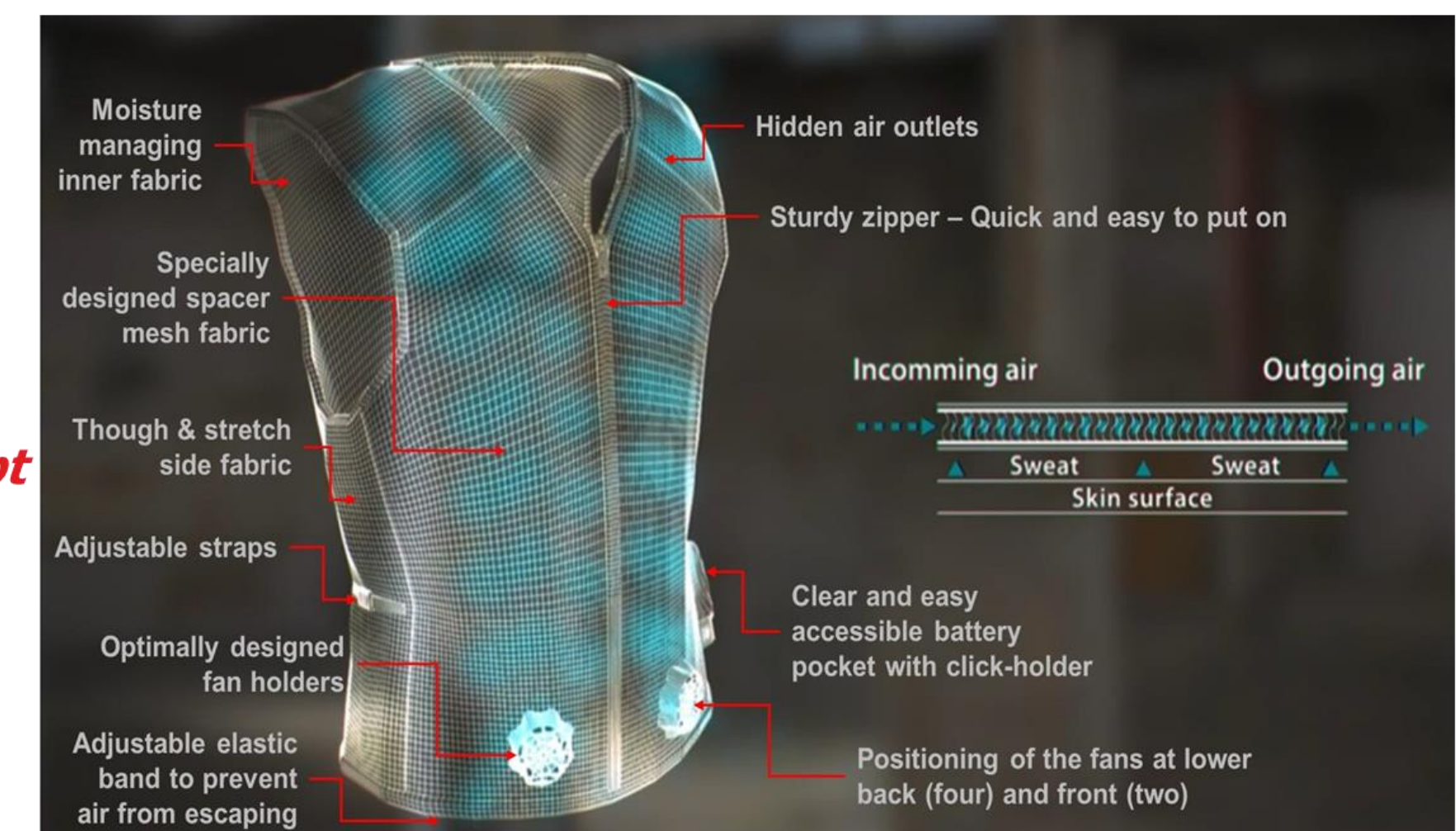
- Wet systems (dipping them into water or adding water to them) do not last very long, need preparation and will be heavy when water is added.
- Ice vests are cheap, but their temperature cannot be controlled, and they often do not stay cool long enough to be practical.
- The same is true for most PCM based cooling vests.
- Ice and PCM systems need preparation (usually by cooling the packs in a fridge).
- In addition, if the cooling system is too cold, this will result in reduced heat transfer from the body to the environment (sweating is inhibited).
- Water-cooled garments require that the worker be tethered to a system that circulates the cool water, which limits the person's range of operation or requires a heavy wearable solution (with pump and cooling unit).
- Water-cooled garments require that the worker be tethered to a system that circulates the cool water, which limits the person's range of operation or requires a heavy wearable solution (with pump and cooling unit).
- Air blowing systems potential hinder the user since the clothing will be "inflated".
- Many of the wearable personal cooling systems are too heavy or too cumbersome to be practical in a work environment.

3

Teijin Active Cooling Vest Concept

Enhanced Sweat Evaporation

- Innovative design & technology
- Easy to use
- Comfortable to wear
- Naturally regulating
- Plug-and-play concept
- Ice & water free
- Constant cooling
- Body fitting cut



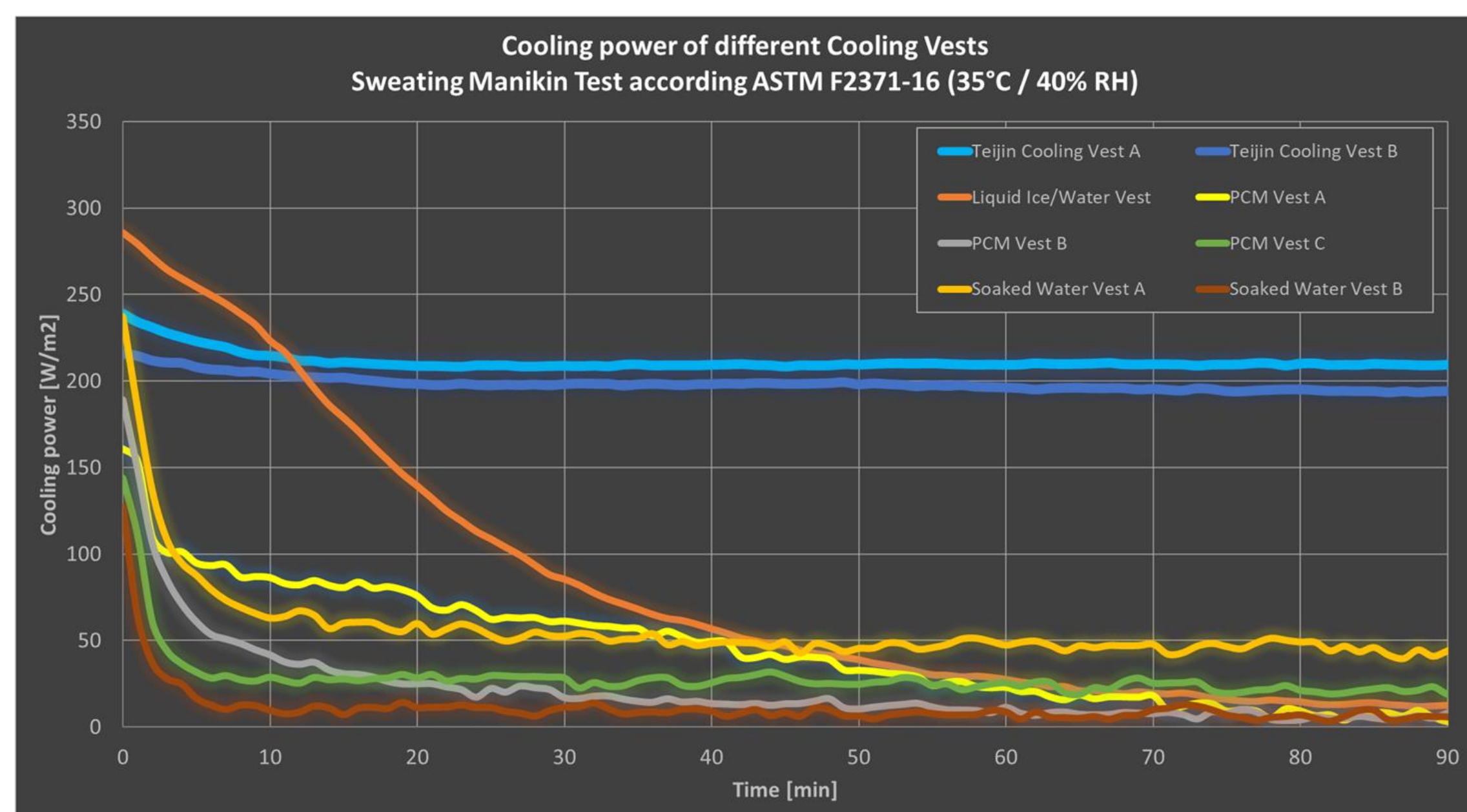
www.teijinsmartsafety.com/active-cooling-vest
www.youtube.com/watch?v=zC0-HTxwLdI
www.youtube.com/watch?v=3snXKFNXVco



4

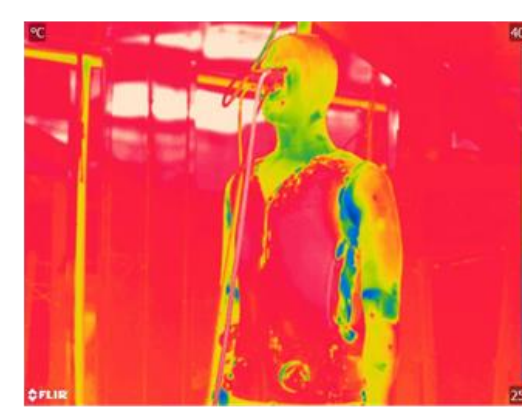
Body Cooling possibilities

Different principles - Sweating Manikin Test



*Tests of Cooling Vest @ AITEX-test institute

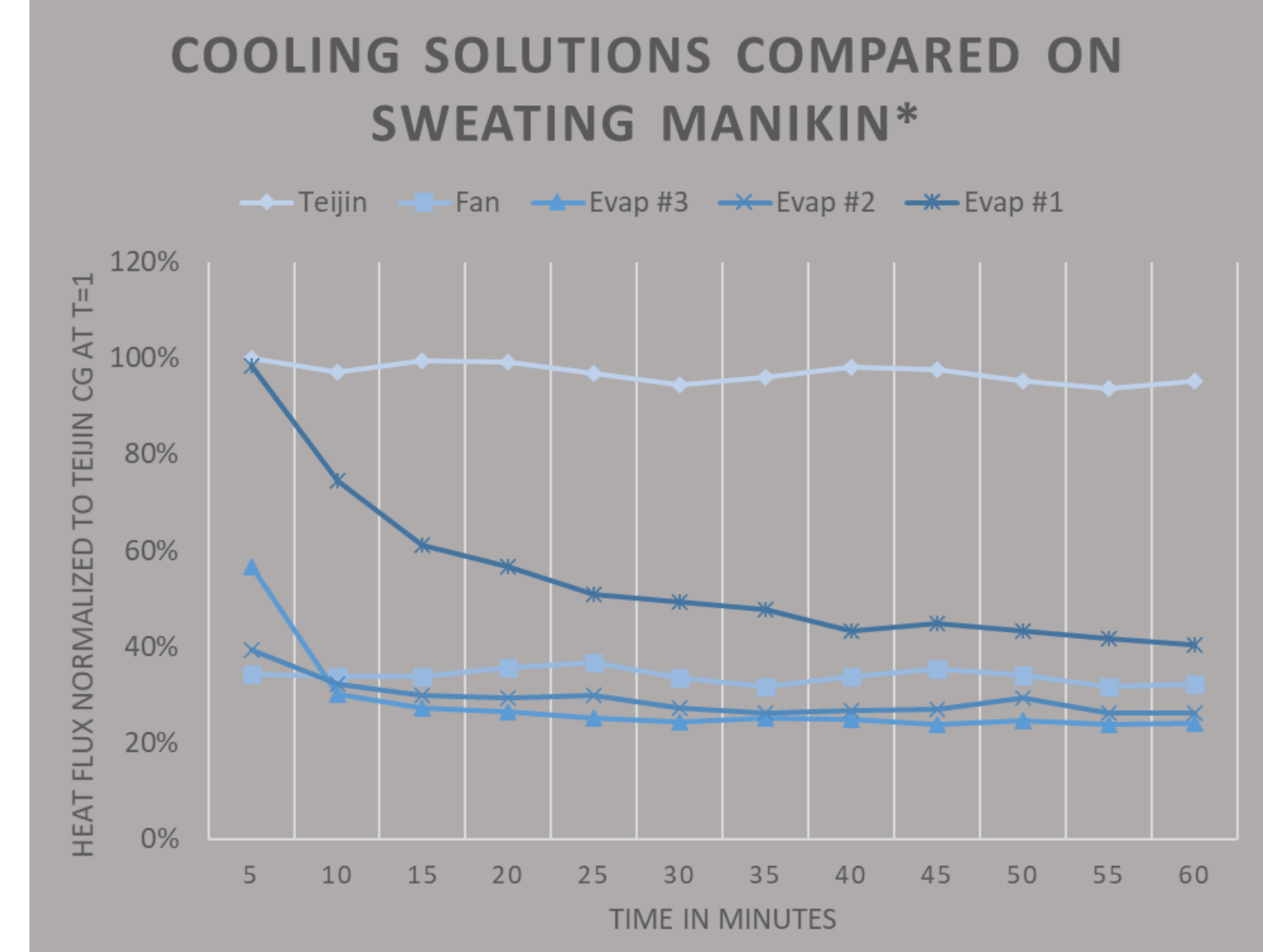
Cooling power of Ice/Water/PCM solutions drop quickly



5

Teijin Active Cooling Vest Concept

Sweating Manikin Test – with FF uniform



*Tests at Teijin's test facility in Nantong/PRC



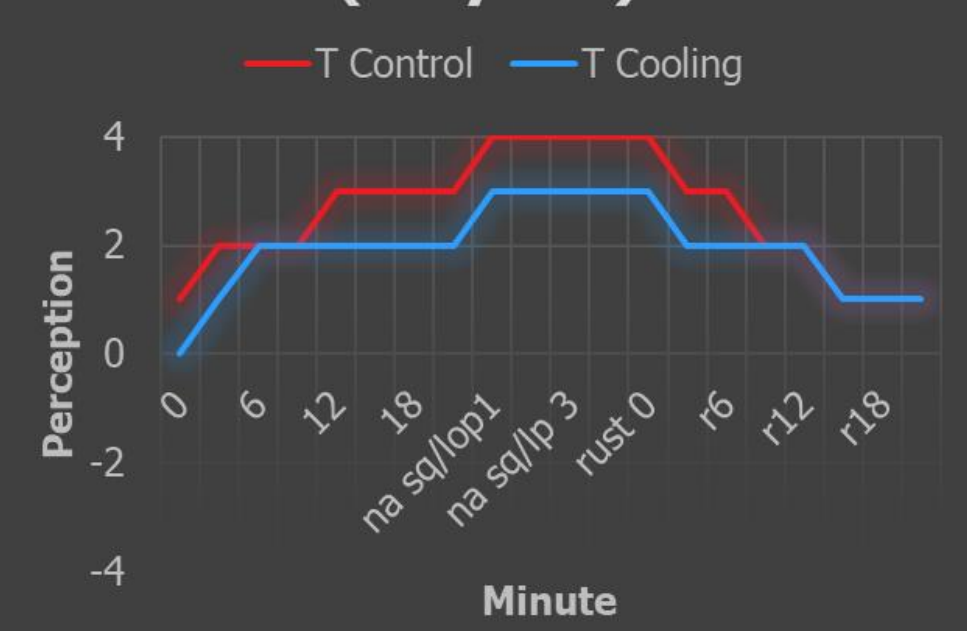
6

Teijin Active Cooling Vest Concept

Human Endurance Test – Perception levels



Perceived Temperature - Scale -4 (very cold) to 4 (very hot)



Perceived Intensity Level - scale 6/20



Room condition: 35 C, 60%RH
Wear the sample on the skin.
Wear suit and equipment.
Walking on a treadmill.

7

Working together towards
a safer society.

Dr. Christian Norhausen

Senior Marketing & Sales Manager
Leader Smart Safety
Phone: +49 (0)151 1125 1660
E-mail: christian.norhausen@teijinaramid.com

TEIJIN

TEIJIN SMART SAFETY