



**Clean,  
sanitize,  
decontaminate:**

How to choose your  
solution.

# Cleaning in the spotlight

For some businesses, cleaning, sanitization and decontamination are really important issues; they have a significant impact on procedures and organization and, ultimately, on their bottom line and sustainability. These businesses have to deal with a range of significant risk factors with respect to washing staff uniforms and equipment, and they must focus on cleaning as one of the main themes in running the business itself.

The question here is “do they know the best solutions to assure the cleaning level they require”?



## How to get the needed level of cleaning?

**Our experience suggests that, more often than not, the answer is “no”.**

What are the reasons for this? Sometimes it is the nature of an organization or the particular practices of an industry, e.g. different management styles in hospitals and nursing homes can lead to adopt different cleaning solutions to prevent contamination, and some can be more efficient than others. In other cases, it is simply that technological development is way ahead of the game and decision-makers just can't keep up. Then again, it could also be because relevant changes in organizations, facilities and procedures may be required to be able to adopt the most advanced solutions, therefore they get filtered out of the viable options in favor of simpler ones.



Target for this paper are companies that handle internally their own cleaning, and companies that provide cleaning services at different levels.

This paper aims to highlight significant problems in cleaning and decontamination, and to provide concrete solutions that many businesses often underestimate.

**The targets for this paper are both companies that handle their own cleaning in-house** and firms that provide cleaning services at different levels (standard cleaners but also advanced cleaning services that handle special,

high-level cleaning). The goal is to illustrate options and technologies in both standard and advanced cleaning.

We will clearly identify the issue of cleaning, **hygiene and decontamination in the various aspects** of business operations. We will classify the different levels of cleaning needed, explaining how each level impacts on the organization and its procedures, and what technologies and services are required to put in place the desired level of hygiene. We will complete the paper with a case study: the implementation of a high-level decontamination solution.

# Cleaning levels

Each business has (or does not have, as the case may be) its own cleaning needs. These cleaning needs can be grouped into two spheres, both of which concern the risks to the business posed by inefficient cleaning.



The target affected by the risks of cleaning failure



The scale measuring the risks of cleaning failure

## The risks target

The risks of non-compliant cleaning can impact two main targets:



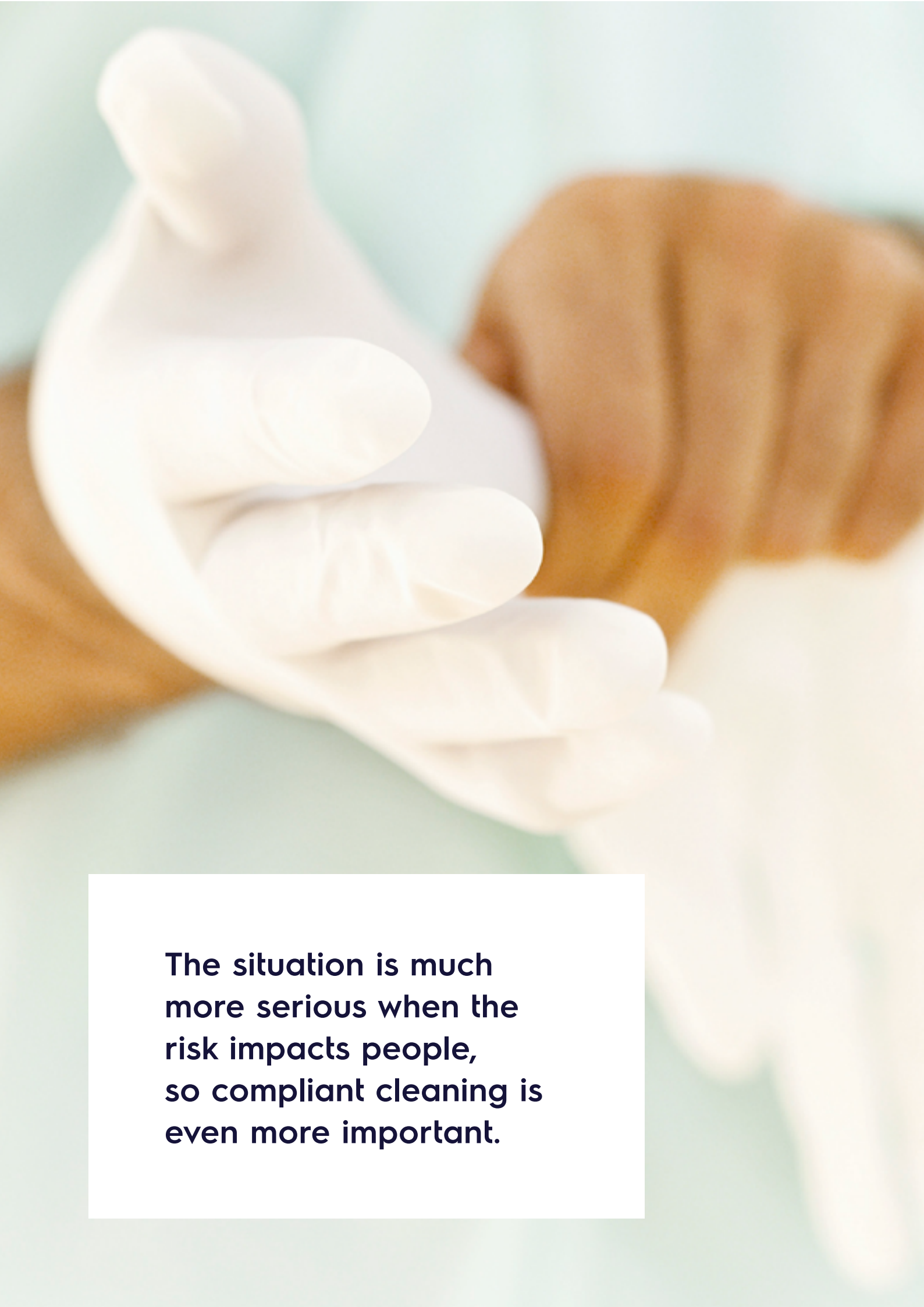
Products/services



People (employees or users)

**In the first case**, the risks from inadequate cleaning of garments, staff uniforms and equipment impact products or services, which can end up being damaged. Examples of these situations range from the disruption of hotel services when linen is not adequately clean, through to the damage that can occur to microelectronic components if an employee enters a cleanroom in a suit that is not completely free of even the tiniest speck of dust.

**In the second situation**, the risks are much more serious because they affect people and could prove to be deadly: just consider hospital patients catching an infection due to a failure in decontamination procedures, or worse still, firefighters getting cancer because contaminating micro-particles not completely removed from their gear due to inadequate cleaning.



**The situation is much more serious when the risk impacts people, so compliant cleaning is even more important.**

# The risk scale

We can identify 3 dimensions for cleaning-related risks: low, medium/high and specific.

1.

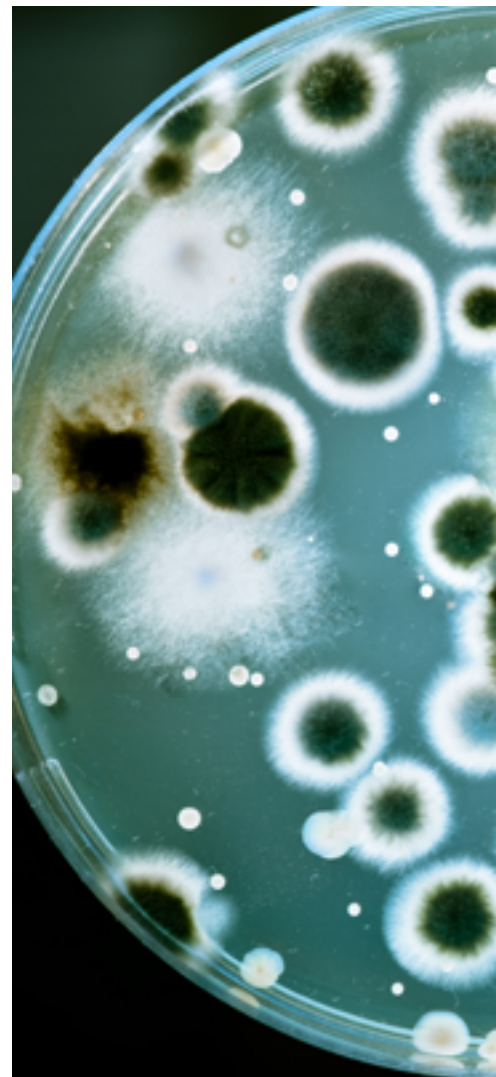
## The low-risk dimension

The cleaning risk in businesses where failure to meet cleaning needs does not cause harm to people (employees or users) or disruption to products/services is low; in these cases, either cleaning is not needed, or it can be easily obtained. As an example, standard manufacturing businesses like furniture or stock mechanical parts producers normally do not have to concern themselves overmuch with cleaning uniforms and tools used during the manufacturing process. This dimension involves standard cleaning solutions.

2.

## The medium-high risk dimension

The medium-high risk dimension arises in businesses where a failure to meet cleaning standards can result in disruption of products/services and/or in customer and user health issues. Industries in this range include hospitals and nursing homes, where it is important to grant hygiene to avoid infections risks and a particular attention is given to linen and professional clothing; but also Ho.Re.Ca. and food production in general, where the risks of infections are smaller, but the service provided can be highly compromised by hygiene issues. In this dimension, we talk about hygiene, in terms of both the product and the operational environment.



# 3.

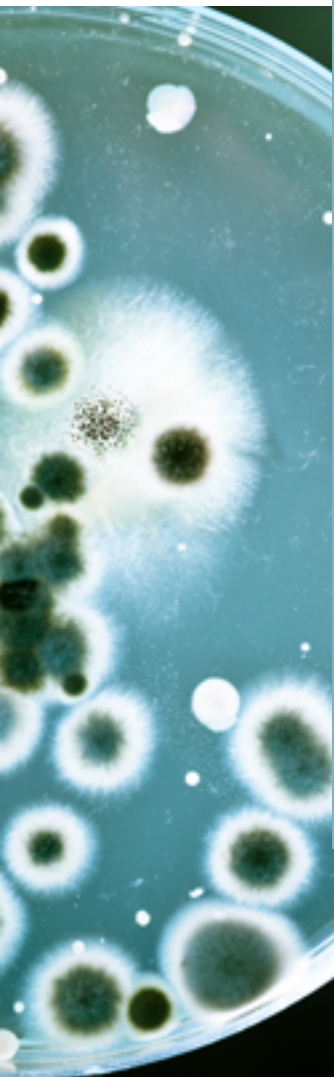
## The specific-risk dimension for specific needs

The specific-risk dimension occurs when cleaning needs go beyond the usual standards and technologies available in the market, and require both special technologies and an approach based in a clear vision of laundry and a deep understanding of the processes. In such situations entire batches of a valuable product may be destroyed or people may be seriously harmed by failures in the cleaning system. The aforementioned “cleanrooms” in microelectronics production are an example of the first issue, while health protection for firefighters is an examples of the second one. In this dimension, simple solutions for cleaning or hygiene are no longer enough.



HACCP stands for Hazard Analysis Critical Control Point, and it is a Food Safety Management System in the food chain. In many countries, HACCP is mandatory for businesses with contamination risks such as food processing industries. Electrolux Professional laundry solutions have received HACCP certification from HACCP International, proving that these products are safe for use in the food industry and helping to achieve HACCP standard.

This certification usually applies to food service equipment; HACCP laundry solutions emphasizes the crucial role laundry has in preventing contamination. It has also set the Electrolux Professional laundry standards as the highest across the globe. Also, food business professionals that formerly had to outsource their laundry operations to guarantee their HACCP compliance can now rely on Electrolux Professional laundry equipment to bring those operations safely in-house.



# A map of the cleaning levels

We can use the three main dimensions for gauging cleaning needs to build a matrix. The matrix can serve as a “map” to identify the relative position of a company in terms of cleaning needs.

	LOW RISK	MEDIUM - HIGH RISK	SPECIFIC NEEDS
PRODUCTS	<ul style="list-style-type: none"><li>• Standard manufacturing</li></ul>	<ul style="list-style-type: none"><li>• Agrifood</li><li>• Hospitality and hotels</li></ul>	<ul style="list-style-type: none"><li>• Microelectronic</li><li>• Pharmaceutical</li></ul>
PEOPLE	<ul style="list-style-type: none"><li>• Food services</li><li>• Restaurants</li><li>• Mining</li></ul>	<ul style="list-style-type: none"><li>• Hospitals and clinics</li><li>• Food processing</li><li>• Nursing homes</li></ul>	<ul style="list-style-type: none"><li>• Nuclear plants</li><li>• Firefighting</li><li>• Infectious disease centers</li></ul>



This matrix can be used by companies doing their own cleaning to pinpoint the best technologies they need for their issues, or by professional cleaning services to sort their client base. This way, they'll have all the information they need to decide which cleaning technologies are best for them.



# Technologies for different levels of cleaning needs

As we said earlier, the matrix can help to identify the most appropriate technologies to use in industrial cleaning. These technologies can, in turn, be sorted into levels, according to their impact on the organization and its procedures, and to the complexity, structure and newness of the operations involved.

## Level 1:

### Standard Industrial Cleaning / Low Risk

At this level, there is little or no risk connected to failures in cleaning, and almost none of the companies with the need for this level of cleaning use special technologies. Cleaning services are outsourced to specialized companies, using professional washers and dryers.

The technology issues here are strictly business-related:

- consumption of energy, water and consumables
- cleaning and sanitization performance
- machine lifetime
- connectivity of appliances and general ergonomics
- after sales assistance



# Level 2:

## Barrier Washers / Medium-High Risk

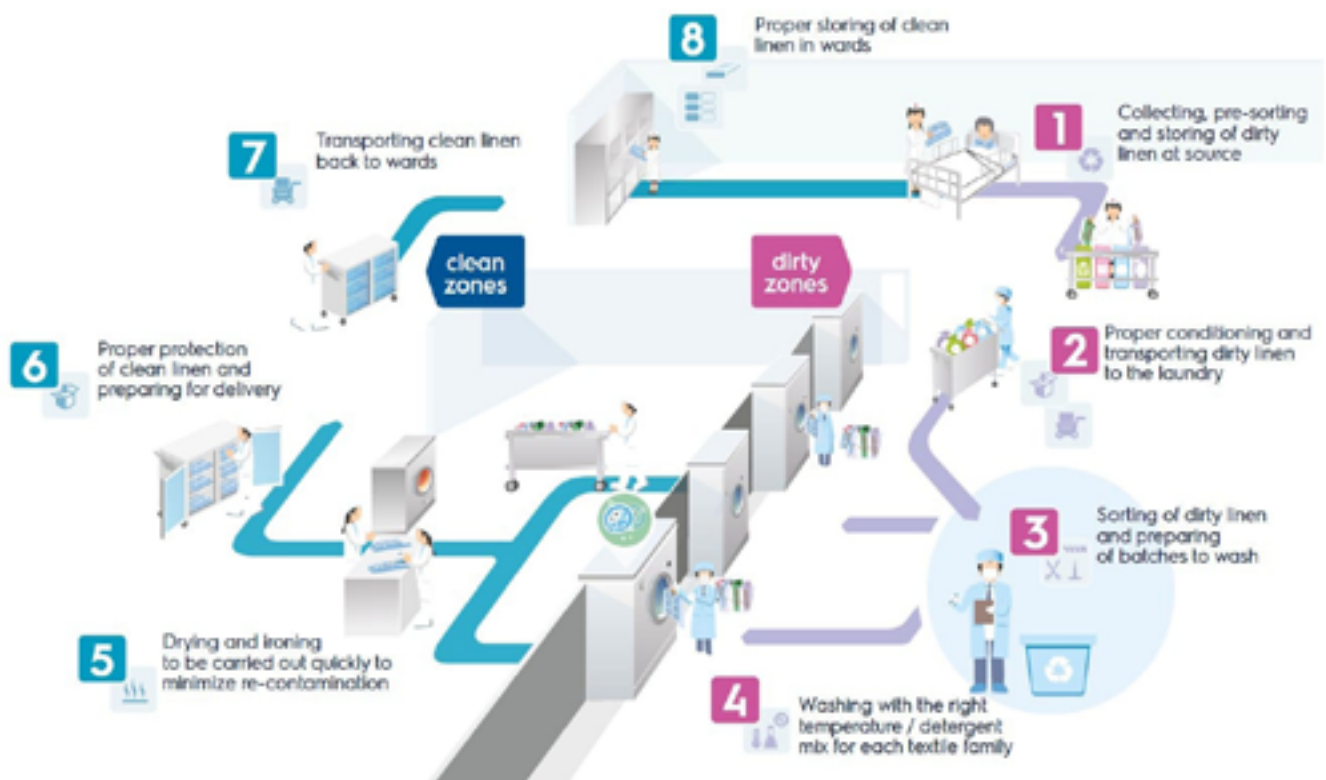
**This needs level encompasses medium-to-high risks, where considerable economic loss in products and harm to people come into the picture.**

Many companies at this level consider cleaning to be a strategic operation, so they often have their own in-house cleaning facility. The best technology to address cleaning needs in these cases is the barrier washer: a professional laundry solution aimed at preventing cross-contamination and assuring total cleaning of all sorts of linen and uniforms. Barrier washer is both the name of an appliance and the actual laundry process: the appliance has specific design and construction that makes it possible to create a process where clean and dirty linen do not come into contact; in a barrier washer laundry solution, the machine is built into a wall between two separate rooms connected only by the washer.

Soiled laundry is loaded into the washer from one room, and unloaded only when clean from the other.

This procedure assures that a clean load never comes into contact with a dirty load, thus preventing cross-contamination and failures in the cleaning process.

Setting up a barrier washer solution is not just a matter of choosing the right appliance (basing the decision on the same parameters as the ones for level 1 appliances); it requires the organizational spaces for this option, and the procedures to correctly operate it. When choosing a barrier washer solution, one of the key elements to evaluate is the capability of the vendor/supplier to support the buyer throughout its implementation, from workflow study and definition to room planning, all the way down to procedures design and enforcement.



Barrier washers are professional laundry solutions that help prevent cross contamination and grant thorough cleaning for different wares or equipments.

# Level 3:

## Comprehensive cleaning facilities/Specific Needs

This is the highest level of cleaning need, where human lives are at stake either immediately or in the long run. In this case, setting up a barrier washer laundry solution is not enough: special needs are involved, and depending on the case, the washing procedure itself may be insufficient. Particular decontamination procedures, or the necessity to have separate washing processes for different gear and equipment underpin the pursuit of comprehensive solutions, requiring different appliances to be used in the cleaning cycle. Still, the most important issue here is the washing technology involved: when the objective is decontamination each case must be addressed individually, with an in-depth analysis of the required outcomes.

This often leads to customized technological development, such as the creation of totally new laundry appliances, suitable for solving complicated decontamination issues. We will showcase one such development in the case history related to this paper: the application of a liquid carbon dioxide operating washer to implement a special decontaminating solution.



This task normally requires a structured partnership between the company with decontamination needs and its suppliers/vendors. They must be able to deliver cutting-edge technology, flexibility in both operations and product customization, and the aforementioned support capability throughout the whole process.

The case study in this paper specifically describes this implementation: the players in the case study are Electrolux Professional and the specialist company Decontext, which partnered to build a special laundry solution to thoroughly decontaminate the turnout gear of firefighters. The partnership led to the creation of a totally new laundry solution: a washer studied and engineered by Electrolux Professional that uses liquid carbon dioxide to clean turnout gears and particularly the special membrane inside them.

Required level of cleaning technologies

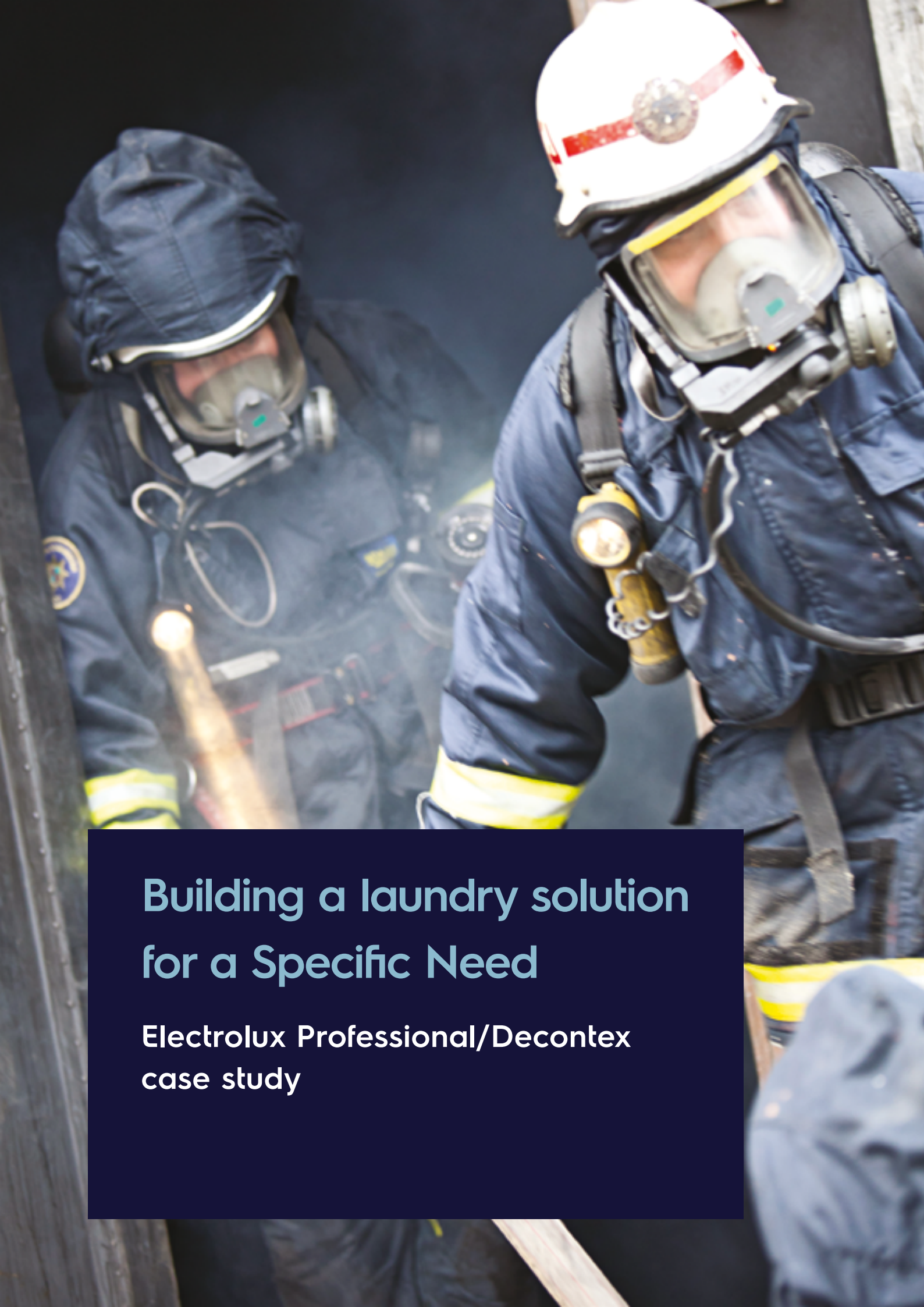
LEVEL 1

LEVEL 2

LEVEL 3

LEVEL 3b

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# Building a laundry solution for a Specific Need

Electrolux Professional/Decontex  
case study

# The issue: protecting the protectors

All firefighters wear Personal Protective Equipment (PPE), also known as turnout or bunker gear, normally composed of helmet, suit (jacket and trousers) gloves, boots and a SCBA (Self-contained breathing apparatus). PPE is the only protection firefighters wear during an operation, and it is exposed to a number of contaminating agents even during the simplest maneuvers of putting out a fire (let alone the ones involving “special” fires from burning of chemicals, or actions among debris and powders from collapsed buildings).

Most of these agents, such as VOCs, PAHs and dioxins, are carcinogenic and highly volatile; when they contaminate the firefighter’s PPE, they are highly likely to also contaminate any environment they come into contact with, and to cross-contaminate other gears. In addition, they can of course be inhaled or otherwise come into contact with the skin, causing damages to the firefighter health that can range from standard inflammation to serious cancers. For these reasons PPE requires special cleaning treatments, and procedures are normally implemented to ensure that firefighters always wear clean and functional PPE: the danger for a praised and beloved profession like firefighting does not come only from selflessly facing fires and falling buildings to save others’ lives, but also (and more subtly) from not fending off a more insidious enemy, hiding on and inside protective gear; firefighters’ lives are therefore concretely threatened by cancer if such risks are not removed by thoroughly decontaminating their gears and uniforms.

The risk of cross contamination and the particular nature of the contaminating agents call for an ad hoc laundry solution; but this is when things get more complicated:

- the particular components used for the jackets and trousers in PPE suit require special treatment
- some PPE components as the SCBA are better washed with specific techniques

**The PPE is the only protection firefighters wear during an intervention, and it is exposed to a great number of contaminating agents.**





## The problem: a Specific Need

This special treatment is the most challenging issue: turnout gear consists of multiple layers of materials – together called a composite – made up of an outer shell, a moisture barrier, and a thermal liner.

This membrane structure has different purposes:

- it keeps water and body moisture in the internal chamber of the membrane structure, so that when the firefighter is exposed to extreme temperatures the water does not heat up causing searing.
- absorbs contaminants and keeps them inside the turnout gear

The bad news is that washing this gear with water can be a problem, because neither water nor detergent are fully capable of dissolving/eliminating contamination due to water and detergent density and to the micro pores of the membrane: washing with water is still an important practice after any intervention, but water is unable to pass through the membrane and clean out the smallest (and more dangerous) particles. A solution to address this issue and avoid the risk of cancer was required.



## Decontex: specializing in PPE cleaning, handling and repair

**Decontex is a Belgian-based company specializing in complex decontamination systems. They provide special services for PPE in various fields, focusing in particular on firefighters' personal gear and equipment.**

To solve the problem of using water to decontaminate firefighters' PPE, Decontex turned to space: NASA developed a washing technique utilizing liquid Carbon Dioxide (LCO<sub>2</sub>) to clean astronauts' gear. This technique requires the CO<sub>2</sub> to be pressurized until it becomes a liquid; it can then be used as a solvent to wash items and being non-polar, low density and low viscosity, it is a really good solvent.



All these features mean LCO2 can perfectly wash the membrane without damaging it. Just one problem remained on the table: finding a washer that can operate with pressurized CO2 instead of water, and create the right process. This is where Electrolux Professional came in. Electrolux Professional worked closely with Decontex to adapt an Electrolux Professional appliance to become an LCO2 decontamination solution. The machine is at the very heart of the complex Decontex decontaminating system for cleaning the PPE of Belgian firefighters.



## The next step:

### **Fraport and CO2DEX in collaboration with Decontex NV and Electrolux**

Fraport Aviation Academy in Ljubljana (Slovenia) and Decontex SI - CO2DEX, joined forces.

The scope of CO2DEX facility within Fraport Aviation Academy was to construct the first decontamination centre for complete personal firefighting protection equipment, including garments, helmets, gloves, boots and breathing apparatuses. Electrolux Professional and Decontex NV support was crucial in developing cleaning and decontaminating solutions for the centre, and lead to the world's first complete firefighter's equipment decontamination

**Liquid CO2 washers: bringing in space technology to fully decontaminate the protectors' protection gears**

centre. The focus was not only on technology, with the previously seen LCO2 operating washer, but also on developing the whole process: considering all the risks firefighters are exposed to and match the technologies, workflows and objectives to reach full decontamination of equipment as well as improved safety and health of firefighters in the long run. Moreover, in this way the importance of correctly decontaminating firefighters' gears is transmitted at a local level, but also to the many groups of firefighters visiting the Academy every year from all over the world.

# Closing words:

## the challenge of decontamination in cleaning needs and cleaning technologies

Cleaning can be a very important process in some businesses; adopting the right technology can largely reduce risks connected to cleaning failures, but the most important thing is a clear vision of laundry. When the risks pose a hazard to people's lives, such as when contamination is involved, the decision surrounding the right technology must be taken considering all the issues at stake. A supplier capable to encompass all the aspects of the matter

is fundamental to achieve consistent results. The best supplier is always the one that can provide the widest range of solutions, the most experience and the best pre- and after-sales service, but most of all the one that looks at the problem not from the perspective of single technologies, but considering workflows, processes, education and objectives, all in a solution oriented approach.





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- ▶ Our products are 100% quality tested by experts

