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**Evidence Based Cleaning Practices
Disinfecting when required with
PCS Hypochlorite Disinfectants**

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Cleaning and Disinfecting with PCS Hypochlorite Disinfectants

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Introduction

The environment in health care settings has been a contributor to the spread of pathogens and therefore indirectly to the acquisition of hospital acquired infections. Hospitals have in the past been encouraged to use a one step cleaner disinfectant process in order to reduce the spread of pathogens.⁽¹⁾

However, cleaning and disinfecting are two distinct processes, and new research supports an approach that separates cleaning and disinfecting. Process Cleaning Solutions (PCS) has developed products and procedures that allow for cleaning and disinfecting separately, in order to further reduce the spread of pathogens in health care facilities.

Separating Cleaning and Disinfecting

For a long time many people thought that it was simply easier and more convenient to clean with a disinfectant cleaner, since it involved a single-step process. People also felt that cleaning with a disinfectant gave added security that surfaces cleaned are safe from microbial contamination. In fact, neither may be true. Cleaning with a disinfectant can create a false sense of security.

There are a number of reasons why we have to rethink these old views:

- Cleaning with a disinfectant and not precisely following the manufacturer's instruction for its use can create problems. For example, it is hard to determine during normal cleaning whether the disinfectant has been left wet on the surface long enough for the surface to be considered disinfected. Typically some surfaces will dry before the full dwell time recommended by the manufacturer. It is also difficult to determine whether the level of soil on a surface is within the range that the disinfectant can handle.
- Some disinfectants are absorbed by cleaning cloths, making the disinfectants unavailable for application to the surface.⁽²⁾

Disinfectants can be inactivated by detergent residues left in cleaning cloths after laundering. (26)

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In the United States the EPA Antimicrobial Testing Program has many hospital grade disinfectants Under Agency Review.

There are several circumstances wherein a product may be listed as "Under Agency Review."

- A Testing of this product showed failing results.
- B The products were tested incorrectly.
- C The product sample had contamination concerns.
- D Testing had mixed results.

When these circumstances occur, the Agency enters a discussion with the registrant regarding possible label changes, retesting, mitigation measures or enforcement procedures.

As of October 28th 2010 The agency list products including those under review .

A few examples are.

- 777-68 Reckitt Benkiser Lysol Brand Disinfecting Wipes
- 777-94 Reckitt Benkiser Lysol Disinfectant Concentrate
- 1677-198 Ecolab Inc Quantum TB disinfectant.
- 1677-216 Ecolab KX -6176
- 1839-155 Stepan Company BTC 2125M 20% solution
- 1839-167 Stepan Company BTC 885 Neutral Disinfectant Cleaner
- 5741-9 Spartan Chemical Company Sparquat 256 Germicidal Cleaner.
- 5813-40 Clorox Pine Sol spray19054
- 6836-57 Lonza Inc Anlage 128
- 6836-205 Lonza Enviro Solutions 256 Neutral Disinfectant Concentrate
- 10324-93 Mason Chemical CO Marquat 64 PD
- 46781-8 Metrex Research Corp. Caviwipes
- 56392-7 Caltech Industries Dispatch Hospital Spray Disinfectant
- 70627-15 Diversey Inc Triad 111 Disinfectant Cleaner
- 70627-21 Diversey Inc Virex II 128 One Step Disinfectant Cleaner and Deodorizer

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70627-56 Diversey Inc Oxivir Tb

70627-24 Diversey Inc Virex II 256 One Step Disinfectant Cleaner Deodorizer.

Complete list (27)

- Some pathogens like *C.difficile* and *Noro* virus are not completely removed from the environment when surfaces are cleaned with disinfectant cleaners.⁽³⁾
- Many surface disinfectants contain quaternary ammonium compounds (QUATs), phenolics, hydrogen peroxide or sodium hypochlorite, which can cause skin and respiratory irritation. Disinfectants are one of the leading allergens affecting health care providers.⁽⁴⁾ Female cleaning staff have the highest risk of having children with birth defects.⁽⁵⁾
- Epidemiologic and professional reports provide strong evidence that exposure to cleaning products is associated with asthma and other respiratory symptoms:
 - Delclos and colleagues (2007) found an approximately twofold increased likelihood of work-related asthma among US health care workers for tasks involving instrument cleaning and disinfecting, use of general cleaning products used on indoor building surfaces, use of powdered latex gloves, or the administration of aerosolized medications.
 - Pechter et al. investigated four US state-based surveillance systems for occupational asthma data during 1993-1997. Despite demographic and employment pattern variations across four states, healthcare emerged as the first or second most frequently reported industry among all occupational asthma cases, based on physician reports. Cleaning products, both cleaners and disinfectants, were the predominant exposure source, followed by latex, glutaraldehyde and formaldehyde, and indoor air pollutants.
 - Rosenman et al. studied the same four surveillance systems to characterize individuals with work-related asthma associated with exposure to cleaning products and found that asthma cases were

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reported across a wide range of job titles. In the report by Health Care Without Harm, “cleaners, disinfectants, and sterilants” topped the list of factors with strong evidence of asthma potential in healthcare. The report recommended implementing safer alternatives or elimination when possible.⁽⁶⁾

- Cleaning with disinfectants has the potential to create “super-bugs”, especially in hospitals where we have bacteria exposed to both antibiotics and disinfectants. It is well known that over-prescribing antibiotics can create super-bugs, especially when they are used in a way that makes them ineffective (e.g. not taking the full prescription as recommended, or when we take antibiotics for viruses like a cold or flu, which they have no effect on). Like antibiotics in the body, disinfectants are used to treat or kill infectious bacteria on surfaces. Even with our best efforts some bacteria survive on environmental surfaces in our health care facilities. The overuse or misuse of disinfectants can contribute to the presence of antibiotic resistant bacteria in health care facilities. We have been inadvertently contributing to their evolution and expansion with our cleaning.

The European Commission’s Scientific Committee on Emerging and Newly Identified Health Risks posed and answered the following questions on the antibiotic resistance effects of biocides:

“1.a Does current scientific evidence indicate that the use of certain active substances in biocidal products in various settings as mentioned above can contribute to the occurrence of antibiotic resistant bacteria, both in humans and in the environment?”

“Yes, current scientific evidence (including bacteriological, biochemical and genetic data) does indicate that the use or misuse of certain active substances in biocidal products in various settings may contribute to the increased occurrence of antibiotic resistant bacteria, both in humans and in the environment.

“2.c If yes, which types of areas of application create the highest risks for increasing antibiotic resistance?”



“Any application that encompasses the widespread regular use of biocides at sub-lethal concentrations maintains a continuous selective pressure and thus increases the risk of selecting resistant bacteria. This may occur in a number of uses including hospitals, food production and cosmetics manufacturing etc.” ⁽⁷⁾

Gilbert & McBain (2003) stated that “in any environment there is likely to be a continuum of biocide concentration ranging from treatment concentration to nil”. This, in effect, presents sub inhibitory concentrations in the environment to which step-wise decreases in susceptibility may occur. ⁽⁸⁾

It has never been actually proven that cleaning with a disinfectant cleaner prevents infection better than cleaning with regular detergent. Today there are methods that can be used to instantly validate cleaning scientifically. These are able to show that we can make surfaces safe to use and handle without cleaning with disinfectant cleaners. ^{(9) (10) (11)}

Cleaning with detergents has demonstrated the ability to lower MRSA from health care environment without the use of disinfectants. ⁽¹²⁾

Understanding Cleaning

The process of cleaning is the removal or transfer of surface contamination from environmental surfaces to cleaning cloths. A common misconception is that the cleaning chemical used provides the cleaning. Cleaning chemicals only provide a portion of the cleaning process; removal is accomplished with the cleaning cloth and the procedures used.

The selection of cleaning cloths, the procedures used and the laundering/decontaminating of the cleaning cloths likely impact the outcome far more than the selection of any specific cleaner or disinfectant. (20)

Cleaning of environmental surfaces in health care settings involves wiping over surfaces using friction to transfer soils from surface to cleaning cloth. There is usually no dwell time allowed to suspend soils and no rinsing step to remove suspended soils.

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The repeated use of cleaning and disinfecting products without a rinsing step allows for the accumulation of synthetic organic detergent surfactant and disinfectant surfactant residues on surfaces which the following bacteria have demonstrated the ability to acclimatize, adapt to and consume as a reproductive energy source *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterococcus majodoratus*, *Klebsiella liquefasciens*, *Enterobacter liquefasciens*, *Klebsiella aerogenes*, *Enterobacter agglomerans*, *Staphylococcus albus*, *Proteus sp.*, *Klebsiella oxytoca* and *Brevibacterium sp.*,(22)

Until now, the most common component of cleaning compounds has been surfactants. Surfactants work on the liquid surface interface by lowering surface tension, therefore allowing soils to release from surfaces to be cleaned. They also reduce friction between cleaning solution and cleaning cloth and the surface to be cleaned. This process of emulsifying or suspending soils by lowering surface tension takes time.

Converting cleaning formulations to buffered organic acids without surfactants has the following benefits.

Lactic acid and other organic acids are natural antimicrobial agents that discourage the growth of many pathogens and encourage the growth of many beneficial microorganisms. Lactic acid is commonly added to many food products as a preservative and to animal feed to improve growth of pigs and chickens and prevent infections. It is expected the addition of lactic acid will replace the addition of antibiotics in animal feed without the environmental problem of misuse of antibiotics. (23)

Buffered organic acids are naturally occurring, are safe to use and allow us to clean in a sustainable manner.

Recently, new cleaning compounds have been formulated that avoid the use of surfactants, which have a number of inherent drawbacks. Examples of this new generation of cleaning compounds are given in an Appendix.

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Following Cleaning Procedures

Effective cleaning is the removal of inorganic and organic soils from environmental surfaces, to very low levels. Cleaning procedures need to consistently remove soil and minimize the risk of spreading contamination from one surface to another. (21)

Use of scientific measurements of cleaning efficacy is valuable. ATP monitors are practical and are a reasonably priced tool when used for establishing cleaning processes and training staff. Alternatively microbial testing can be done.

ATP is adenosine triphosphate and is present in all living cells. It is a key component in the “energy transfer system” within cells. The presence of a high ATP level is a good indicator of poor hygiene and a low ATP level is an excellent indicator of good hygiene.

As in the food processing industry, ATP measurements should be used as a measurement of cleanliness needed before the application of a sanitizing/disinfecting agent.

Laundering / Decontaminating Cleaning Cloths

The effective removal of accumulated soils from cleaning cloths is a critical component to any successful cleaning process. Therefore laundering processes need to be reviewed and any required process changes implemented, before a successful cleaning program can be implemented.

Micro fiber cloths require laundering processes that differ from cotton cloths. All institutions should consider auditing laundering practices of micro fiber cloths.

The following are common facts about laundering cleaning cloths:

- Low temperature wash without the addition of hypochlorite bleach allows some of today’s most problematic pathogens (like *C difficile* and *Noro virus*) to survive and potentially be spread throughout all cloths laundered.

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- Having separate cloths for washroom cleaning and washing all cloths together distributes the contamination among all cloths.
- Using wash temperatures of a minimum of 60 degrees C with additional high temperature rinse cycles before wash cycle can be very effective and requires reduced chemical dosing.
- When using lower temperature wash cycles an increase in chemical dosing is required, with additional rinse cycles to remove the detergent from cloths.

An audit of the laundering process requires three kinds of inspection or testing:

- Visual Inspection: Micro fiber cloths that are stained and matted are obvious indications that laundering practices need to be reviewed.
- ATP Testing: ATP tests can provide an indication of organic soil contamination.
- Manual testing: Test cloths with MicroLaundry manual cleaning process (see section on PCS products) which provides quick release of accumulated soil and chemical residues which may be imbedded in cloths. Residual soil and detergent residuals indicate a need for a process change.

Micro fiber cloths impregnated with antimicrobial agents provide little or no protection from microbial contamination contained in the soils picked up on cloths. When cloths contain organic soils including pathogens they can be spread from the cleaning process. The Environmental Protection Agency in the United States does not allow any health benefit claims for cloths containing antibacterial agents.



Cleaning and Disinfecting for Health Care

Disinfectants in health care facilities are required for special situations or high risk areas within the health care environment. A preferred cleaning approach for health care is now as follows:

- Clean with safer cleaning products
- Use a validated cleaning process.
- Restrict the application of disinfectants to pre-cleaned surfaces, and only where they are required.(25)

Application of disinfectants to pre-cleaned surfaces helps to insure their safe and effective use. Cleaning of our hospitals, institutions, schools and public facilities with this approach can: be more effective; be safer; protect us from transferring pathogens from environmental surfaces; and slow the evolution of resistant microbes.

Using PCS MicroClean for Environmental Surfaces

Process Cleaning Solutions collaborates with clients in establishing the most efficient and practical cleaning procedures for acute care and long term care institutions.

Process Cleaning Solutions provides all the needed components for good cleaning: PCS MicroClean, PCS Micro fiber cloths, Reflex micro fiber floor cleaning and PCS MicroLaundry, PCS Micro Fiber Destainer and PCS Process Laundry Cleaner Plus.

PCS MicroClean is an organic cleaner containing buffered lactic acid, sodium citrate ,table salt and food colourant , provides a safe, effective and compatible choice for routine cleaning of environmental surfaces in all settings.

MicroClean contains no surfactants or surface active agents. (These are commonly thought to be a requirement in any cleaning chemical.)

MicroClean cleans and dissolves soil without lowering surface tension. In fact cleaning with MicroClean adds friction to the cleaning process. MicroClean in

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combination with micro fiber and other cloths is ideally suited to the health care environmental surface cleaning process.

PCS MicroClean is a non hazardous natural cleaner certified by ECO Logo criteria CCD 146 I (Cleaning product with Low Potential for Environmental Illness and Endocrine Disruption) and by the *Envirodesic™* Certification Program for Maximum Indoor Air Quality & Minimum Environmental Impact. It is designed for use by and around the most sensitive amongst us and is non hazardous by WHIMIS. It has a health rating of 0 in its concentrated form.^{(16) (17) (18)}

MicroClean contains no synthetic chemicals and no volatile ingredients. It leaves no residues that are incompatible with any subsequent application of a disinfectant and it is unlikely to contribute to bacterial resistance development as all ingredients are derived naturally and are present in most environments. Its ingredients are: buffered lactic acid, sodium citrate/salt of citric acid and sodium chloride/table salt.

Laundering Micro Fiber Cloths with PCS Products

PCS MicroLaundry, PCS MicroDestainer and PCS Process Laundry Cleaner Plus provide all the needed products for establishing an effective laundering process.

PCS pre-moistening of micro fiber cleaning cloths is also one example of a process change that saves time, reduces occupational exposures to hazardous chemicals and improves cleaning results.

Cleaning with MicroClean and following an effective cleaning and laundering/decontamination process contributes to protecting public health effectively .

Cleaning without disinfectants in most situations is sufficient to protect public health, however cleaning needs to be taken seriously and requires a scientific approach.⁽¹¹⁾

Using PCS Bleach / Sodium Hypochlorite Disinfectants

Process Cleaning Solutions has the following disinfectant/disinfectant cleaners with Health Canada registrations:

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PCS SODIUM HYPOCHLORITE DISINFECTANT/DISINFECTANT CLEANER

DIN 02323278 Concentrate contains 1.4% sodium hypochlorite active ingredient. Dilute 16 ml per litre of water. For use on hard non-porous environmental surfaces in health care facilities, institutions, schools and the hospitality industries. Use concentration 225ppm

- 5900-6 6 x 2 L closed loop dispenser package
- 5901-6 6 x 2 L containers
- 5901-4 4 x 3.78L containers
- 5902-2 2 x 3.78 L closed loop dispenser package



PCS 7000 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER

DIN 02314878 Concentrate dilute 32 mls per litre of water. For use on hard non porous environmental surfaces in health care facilities, institutions, schools and the hospitality industries. Contains 0.7 % / 7000 parts per million of sodium hypochlorite. Use concentration 225ppm

- 5905-6 6 x 2 L containers
- 5930-4 4 x 3.78L containers



PCS 250 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER

DIN 02314843 Ready to use formulation. Contains 0.025% / 250 parts per million of sodium hypochlorite. Ideal product and concentration for most institutional needs. Use concentration 250ppm

- 5908-6 6 x 946 mL containers
- 5909-6 6 x 2 L containers



PCS 1000 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER

DIN 02314851 Ready to use Disinfectant/Disinfectant cleaner. Contains 0.1 %/ 1000 parts per million of sodium hypochlorite. Use concentration 1000ppm

- 5906-4 4x3.78L containers
- 5906-6 6 x 946 mL containers
- 5907-6 6 x 2 L containers



PCS OXIDIZING DISINFECTANT/DISINFECTANT CLEANER CONCENTRATE

DIN 02356082. Guaranteed 2% Sodium Hypochlorite when packed. Use concentration 1000ppm

- 5948-2 2x3.78L closed loop dispenser package
- 5948-4 4 x 3.78L containers

PCS 5000 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER

DIN 02360500. Guaranteed 0.5% Sodium Hypochlorite when packed.

- 5955-4 4 x 3.78L containers
- 5955-6 6 x 946mL containers

PCS SODIUM HYPOCHLORITE DISINFECTANT/DISINFECTANT CLEANER CONCENTRATE

DIN 02356090. Guaranteed 2% Sodium Hypochlorite when packed. Use concentration 5000ppm

- 5949-4 4 x 3.78L containers

PCS 7500 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER

DIN 02314886 Ready to use Disinfectant/Disinfectant cleaner for use on hard non porous environmental surfaces in health care facilities, institutions, schools and the hospitality industries. Recommended for targeted use when needed. Contains 0.75 % / 7500 parts per million of sodium hypochlorite. Use concentration 7500ppm

5904-6 6 x 946 mL containers



PCS 500 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER WIPES

DIN 02360535 Guaranteed 0.05% Sodium Hypochlorite when packed.

5952-6 6 x 35 premoistened towels



PCS 1000 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER WIPES

DIN 02360527 Guaranteed 0.1% Sodium Hypochlorite when packed.

5953-6 6 x 35 premoistened towels



PCS 2500 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER WIPES

DIN 02318385 Guaranteed 0.25% Sodium Hypochlorite when packed.

5920-6 6 x 35 premoistened towels



PCS 5000 OXIDIZING DISINFECTANT/DISINFECTANT CLEANER WIPES

DIN 02360519 Guaranteed 0.5% Sodium Hypochlorite when packed.

5950-6 6 x 35 premoistened towels



PCS NO RINSE SANITIZER/CLEANER

For use exclusively on direct food contact surfaces in food plants and food processing industry. Use concentration less than 200ppm

4946-6 6 x 946mL squeeze n pour containers
 4946-4 4 x 3.78L closed loop dispenser package

PCS STABILIZED BLEACH

Contains 2% Sodium Hypochlorite. PCS Stabilized Bleach is labeled and packaged for institutional and commercial use. Can be used to oxidize and remove residual organic soils from environmental surfaces after cleaning.

5945-2 2 x 3.78 L closed loop dispenser package
 5945-4 4 x 3.78 L containers
 5951-6 6 x 35 premoistened towels

PCS MICROFIBRE DESTAINER

Stabilized, low concentration sodium hypochlorite destainer designed to remove imbedded stains and oxidize organic soils from microfibre cloths and floor mops. Contains less than 1% sodium hypochlorite, natural carbonates and sodium chloride.

5944-4 4 x 3.78 L containers



PCS PROCESS CLEANING BUCKETS WITH LIDS

5923 4 buckets/case

5926 4 wet wipe rolls/case



PCS PAIL HOLDER WALL BRACKET

PH-1 each

PCS WIPE CANISTER WALL BRACKET

WMB120W each



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All PCS disinfectant/disinfectant cleaners are registered as low level hospital grade disinfectant/disinfectant cleaners. All products have a 10 minute contact time.

All these products specify in their label instructions for use that surfaces should be cleaned prior to application as a disinfectant. When MicroClean is used to clean surfaces prior to application of a PCS disinfectant/disinfectant cleaner, reactive by products from use of hypochlorite's are avoided. In this way occupational health and safety issues surrounding the use of hypochlorite's can be minimized.

All PCS Disinfectant/disinfectant cleaners are registered as generic sodium hypochlorite/ bleach disinfectants. PCS makes no claim that the disinfectant properties of PCS hypochlorite disinfectants differ from generic sodium hypochlorite/ bleach* .

*Generic bleach /household bleach/ sodium hypochlorite is widely recommended by public health officials and infection control officers world wide to control the most problematic pathogens.

All PCS hypochlorite disinfectants are registered for use on hard nonporous surfaces only.

All PCS liquid hypochlorite disinfectant/ disinfectant cleaners manufactured are stable and have an expiry date of 24 months from the date of manufacture.

All PCS hypochlorite disinfectant/ disinfectant cleaners contain sodium carbonate and sodium chloride for enhanced cleaning and improved surface compatibility.

Hypochlorite's are recommended for use to remove C difficile from health care environments by:

May 2010 C difficile update Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America(IDSA).⁽¹³⁾

June 2009 Revised Health Care Cleaning Manual NHS National Health Care System Britain.⁽¹⁴⁾

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December 2009 Ontario Best Practices for Environmental Cleaning and Prevention of Infections.⁽⁴⁾

All recommendations are for a minimum of 1000 ppm .

Hypochlorite's are recommended and can be trusted to remove Norovirus (24)

Sodium hypochlorite's have the ability to remove dried or fixed organisms and biofilms from surfaces. A fact not commonly understood is that hypochlorite's have the unique cleaning ability of removing attached microorganisms. This ability to remove dried or fixed organisms is likely responsible for the successful removal of many pathogens from environmental surfaces. (CDC Guidelines for Disinfection and Sterilization in Health Facilities, 2008) ⁽¹⁾ ⁽¹⁹⁾ (Noro Virus attach to surfaces) ⁽¹⁵⁾

PCS Oxidizing Disinfectants/Disinfectant Cleaners are effective at reducing environmental contamination either by:

- Providing a final clean to oxidize and remove attached organic soils and microbial contamination.(19)
- Or by applying to environmental surfaces and keeping surfaces wet for the disinfecting contact time of 10 minutes.

PCS application wiper system provides a convenient and reliable method of cleaning with PCS disinfectants.

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PCS recommendations for removing *C.difficile* or *Norovirus* from environmental surfaces

During patient stay.

- Clean all surfaces with a validated cleaning process using PCS MicroClean.
- Re-clean frequently touched surfaces with PCS 1000 Oxidizing Disinfectant/Disinfectant cleaner with PCS wiper. This oxidizes and removes any residual organic matter including microbial contamination of all kinds.

Discharge or terminal cleaning.

- . Clean all surfaces with a validated cleaning process using MicroClean.
- . Wipe over surfaces with PCS 1000 Oxidizing disinfectant or a solution of between 1000 to 5000 ppm of sodium hypochlorite saturate surface..
- . Rinse surfaces and wipe dry.

Benefits of PCS recommended process.

- Clarifies and simplifies the cleaning and disinfecting processes for cleaning staff. Cleaning is performed on all surfaces .Disinfectants are applied to targeted surfaces requiring greater confidence the surfaces are sufficiently decontaminated.
- Improved cleanliness validated by ATP monitoring, microbial testing or other auditing processes.
- Some current best practice health care documents do recommend wiping surfaces twice with separate cloths, using two separate chemistries one for cleaning which differs in chemical composition than

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the disinfectant used as recommended by PCS MicroClean a mild buffered lactic acid cleaner with no surfactants followed by wiping over surfaces with a PCS mildly alkaline hypochlorite disinfectant / disinfectant cleaner significantly reduces the possibility of microbial acclimatization, adaption and ultimately resistance development to cleaning and disinfecting chemical residues.

- PCS Hypochlorite disinfectant/disinfectant cleaners contain no organic ingredients which could ultimately provide a food source for microbes that have learned to survive exposure and adapt to the residues left behind from cleaning and disinfecting of surfaces. These residues include not only the active ingredients such as quaternary or phenol residue depositing disinfectants but also the inert organic detergent ingredients such as surfactants which by their very nature are selected for their ability to be consumed by bacteria (biodegraded)
- Reduces the use of hazardous disinfecting chemicals and supports health care facilities wishing to act environmentally responsible.

Best practice for outbreak prevention and control.

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