HEALTHY HARDWARE® WHITE PAPER

2020

RESEARCH
RESULTS
GOALS
OBJECTIVES

Trimco
SINCE 1949

Healthy HARDWARE®
BY TRIMCO

Anthony Mastroianni
Trimco
amastroianni@trimcohardware.com

EXECUTIVE SUMMARY

This white paper discusses the goals and objectives of replacing highly touched surfaces, such as stainless steel door handles that harbor harmful microorganisms with Healthy Hardware® CuVerro® EPA-registered bactericidal copper alloy door handles in the healthcare environment.

The goals are:

1. To reduce harmful microorganisms in the hospital
2. To enhance infection control practices and reduce hospital acquired infections (HAI's)
3. To communicate to the community the participating companies' investment in public health

While the world battles the COVID-19 pandemic, HAI's continue to pose serious health risks to patients in healthcare settings.

Traditional touch surfaces such as stainless steel door handles "harbor microorganisms that may contribute to HAI's." (1)

EPA-Registered biocidal copper alloy surfaces "actively and continuously kill bacteria (*[1]*MRSA, Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa, E.coli O157:H7, and VRE*), 24 hours a day when cleaned regularly." (2)

The National Institutes of Health's (NIH) recent research, published in the *New England Journal of Medicine*, showed that SARS-CoV-2 was detectable for up to 2 to 3 days on stainless steel while detectable for only up to 4 hours on copper. (3)

Research funded by the U.S. Department of Defense showed an 83% reduction of bacteria on copper alloy surfaces versus traditional surfaces and a 58% reduction in HAI's in intensive care unit (ICU) rooms that had copper versus those that had traditional surfaces. (1)

The Centers for Disease Control & Prevention (CDC) advise "it may be possible that a person can get COVID-19 by touching a **surface or object** that has the virus on it and then touching their own mouth, nose, or possibly their eyes." (4)

NIH agrees: "Results… suggest that people may acquire the virus [COVID-19)] through the air and after touching contaminated objects." (3)

[1] *Laboratory testing shows that, when cleaned regularly, CuVerro surfaces kill greater than 99.9% of the following bacteria within 2 hours of exposure: Methicillin-Resistant Staphylococcus aureus (MRSA), Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa, E. coli O157:H7, and Vancomycin-Resistant Enterococcus faecalis (VRE). The use of CuVerro® bactericidal copper products is a supplement to and not a substitute for standard infection control practices; users must continue to follow all current infection control practices, including those practices related to cleaning and disinfection of environmental surfaces. This surface has been shown to reduce microbial contamination, but it does not necessarily prevent cross contamination. CuVerro® is a registered trademark of GBC Metals, LLC and is used with permission (TR-0002-1509). See www.CuVerro.com for more details.

SETTING.

Building(s): Through the building(s) of the Hospital.

Key Areas of Hospital: Entrances, Lobby, Emergency Rooms, Intensive Care Unit Rooms, and Restrooms

PRODUCT EXAMPLES.

ABOUT TRIMCO.

Trimco® is an industry leader in high-performing door security and protection hardware for government, commercial and institutional buildings including a wide range of Healthy Hardware® bactericidal door hardware products. Trimco's mission is to make a difference by innovating, designing, and manufacturing products that make our world safer, healthier, more accessible, and fashionable. www.trimcohardware.com

OBJECTIVES.

1. To identify highly touched surfaces including door handles manufactured from traditional surfaces such as stainless steel and other metals
2. To replace the traditional door handles with Healthy Hardware® EPA-registered copper alloy door handles
3. To market and publicize the use of Healthy Hardware in the Hospital to the community

RESEARCH SUMMARY ON COPPER ALLOY.

The below is an excerpt from a 'translational science article' published on the NIH web site that summarizes some of the key research from laboratory to clinical findings on bactericidal copper: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4561453/

"Objective:

This is a translational science article that discusses copper alloys as antimicrobial environmental surfaces. Bacteria die when they come in contact with copper alloys in laboratory tests. Components made of copper alloys were also found to be efficacious in a clinical trial.

Background:

There are indications that bacteria found on frequently touched environmental surfaces play a role in infection transmission.

Methods:

In laboratory testing, copper alloy samples were inoculated with bacteria. In clinical trials, the amount of live bacteria on the surfaces of hospital components made of copper alloys, as well as those made from standard materials, was measured. Finally, infection rates were tracked in the hospital rooms with the copper components and compared to those found in the rooms containing the standard components.

Results:

Greater than a 99.9% reduction in live bacteria was realized in laboratory tests. In the clinical trials, an 83% reduction in bacteria was seen on the copper alloy components, when compared to the surfaces made from standard materials in the control rooms. Finally, the infection rates were found to be reduced by 58% in patient rooms with components made of copper, when compared to patients' rooms with components made of standard materials.

Conclusions:

Bacteria die on copper alloy surfaces in both the laboratory and the hospital rooms. Infection rates were lowered in those hospital rooms containing copper components. Thus, based on the presented information, the placement of copper alloy components, in the built environment, may have the potential to reduce not only hospital-acquired infections but also patient treatment costs." (1)

LABORATORY RESEARCH ON COPPER ALLOY & BACTERIA.

The following details the rigorous EPA-Registration test results for CuVerro's copper alloy: (2)

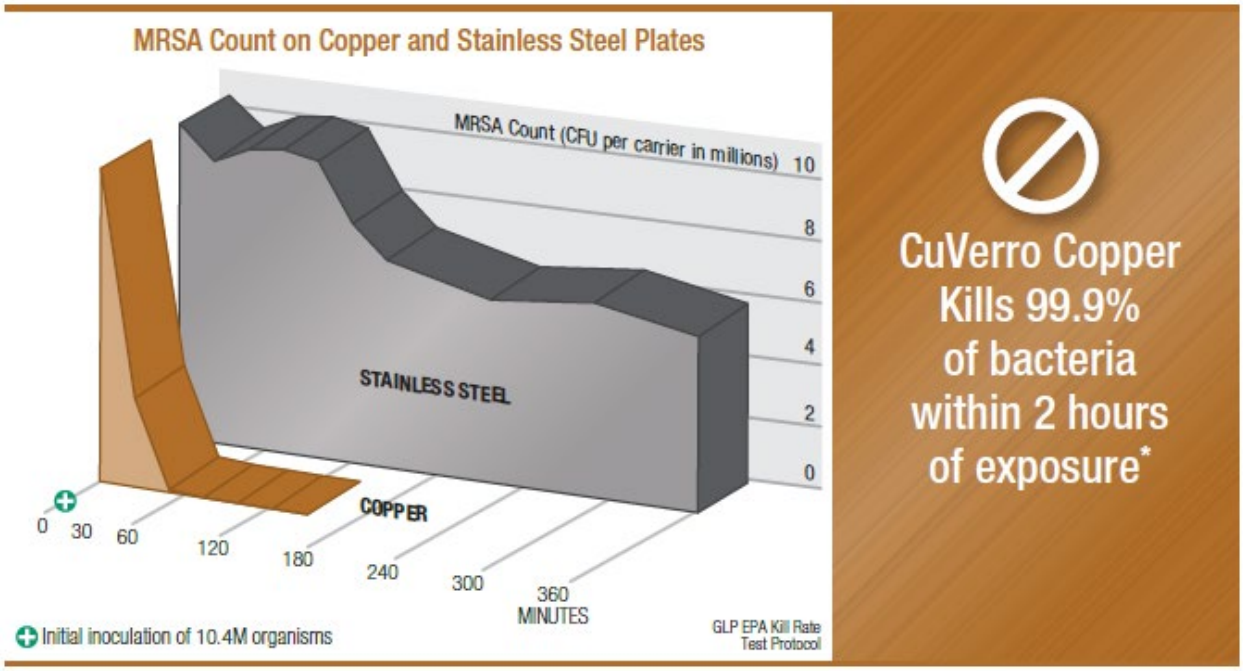
"EPA Registration & Tests (2)

CuVerro® bactericidal copper surfaces represent the first class of solid-surface EPA-registered materials that actively and continuously kill bacteria[1], 24 hours a day when cleaned regularly.

EPA Tests

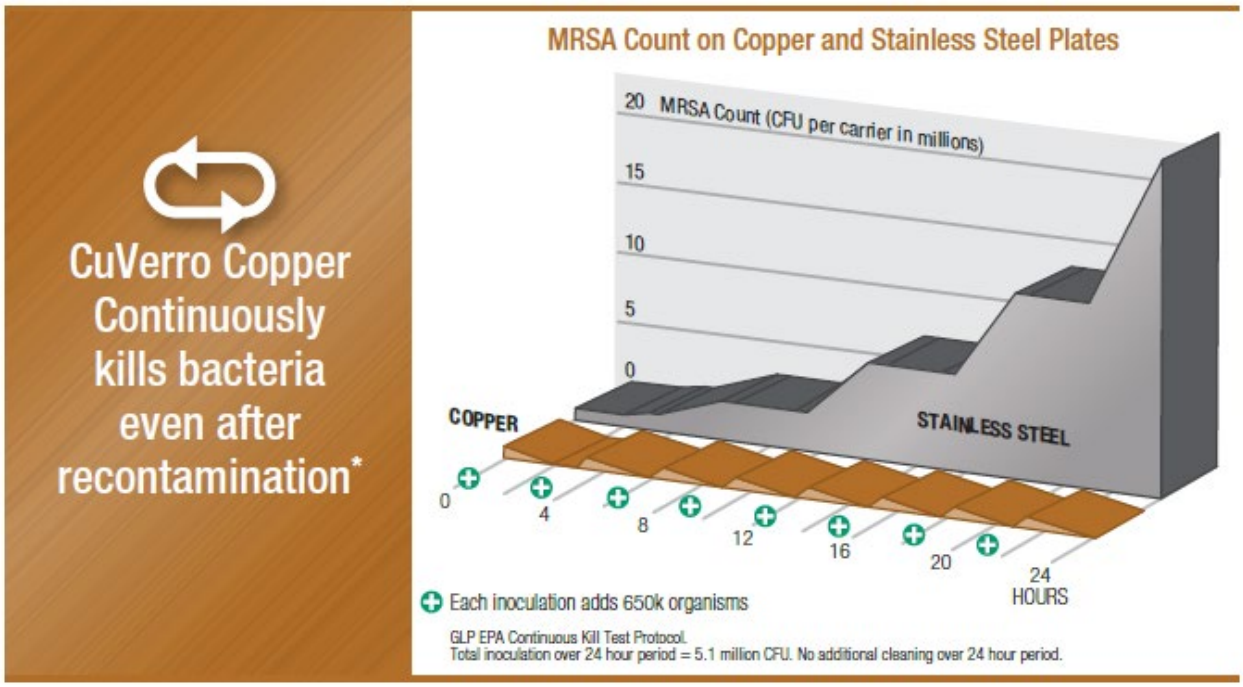
CuVerro alloys have been put through rigorous GLP (Good Laboratory Practices) testing by the EPA to evaluate their effectiveness in killing bacteria responsible for many hospital acquired infections (HAIs). The three GLP test protocols used to support EPA registration of antimicrobial copper alloys with public health claims and associated findings:

1. ***Efficacy as a Sanitizer***
   CuVerro surfaces kill bacteria within two hours, proving its efficacy as a sanitizer.



2. ***Wear Test***:
   CuVerro efficacy does not wear out or wear down over time and continues to help inhibit the buildup and growth of bacteria between routine cleaning and sanitizing steps.
3. ***Repeated Contamination Test***:
   CuVerro surfaces work continuously to kill more than 99% bacteria, 24 hours a day, even after

repeated contamination.



These EPA tests used stainless steel as the control since it represents the most common material used in hospital and surgical settings. The data shows that copper efficacy significantly outperformed stainless steel in all three tests.

Public Health Claims

Based on EPA Registration, products made with CuVerro can be marketed with the following public health claims:

Laboratory testing has shown that when cleaned regularly, this surface:

- Continuously reduces bacterial contamination, achieving 99.9% reduction within two hours of exposure, when cleaned regularly.
- Kills greater than 99.9% of Gram-negative and Gram-positive bacteria within two hours of exposure.
- Delivers continuous and ongoing antibacterial action, remaining effective in killing greater than 99.9% of bacteria within two hours.
- Kills greater than 99.9% of bacteria within two hours, and continues to kill more than 99% of bacteria even after repeated contamination.
- Helps inhibit the buildup and growth of bacteria within two hours of exposure between routine cleaning and sanitizing steps.

CuVerro is proven effective against the following bacteria:

- *E. coli O157:H7*, a food-borne pathogen that has been associated with large-scale food recalls
- Methicillin-Resistant *Staphylococcus aureus* (MRSA), one of the most virulent strains of antibiotic-resistant bacteria and a common culprit of hospital- and community-acquired infections

- *Staphylococcus aureus*, the most common of all bacterial staphylococcus (i.e. staph) infections that can cause life-threatening diseases, including pneumonia and meningitis
- Vancomycin-Resistant *Enterococcus faecalis* (VRE), an antibiotic-resistant organism responsible for 4% of all HAIs
- Enterobacter aerogenes, a pathogenic bacterium commonly found in hospitals that causes opportunistic skin infections and impacts other body tissues
- Pseudomonas aeruginosa, a bacterium that infects the pulmonary tracts, urinary tracts, blood and skin of immunocompromised individuals" (2)

(End of section on EPA Registration Tests)

LABORATORY RESEARCH ON COPPER & SARS-COV-2.

The NIH conducted a study to determine the aerosol and surface stability of SARS-CoV-2 and here are the results:

"A U.S. government-funded study published and conducted by researchers at the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC) reported that the SARS-CoV-2 virus remained viable for up to 2 to 3 days on plastic and stainless steel surfaces vs. up to 4 hours on copper." (9)

From the New England Journal of Medicine:

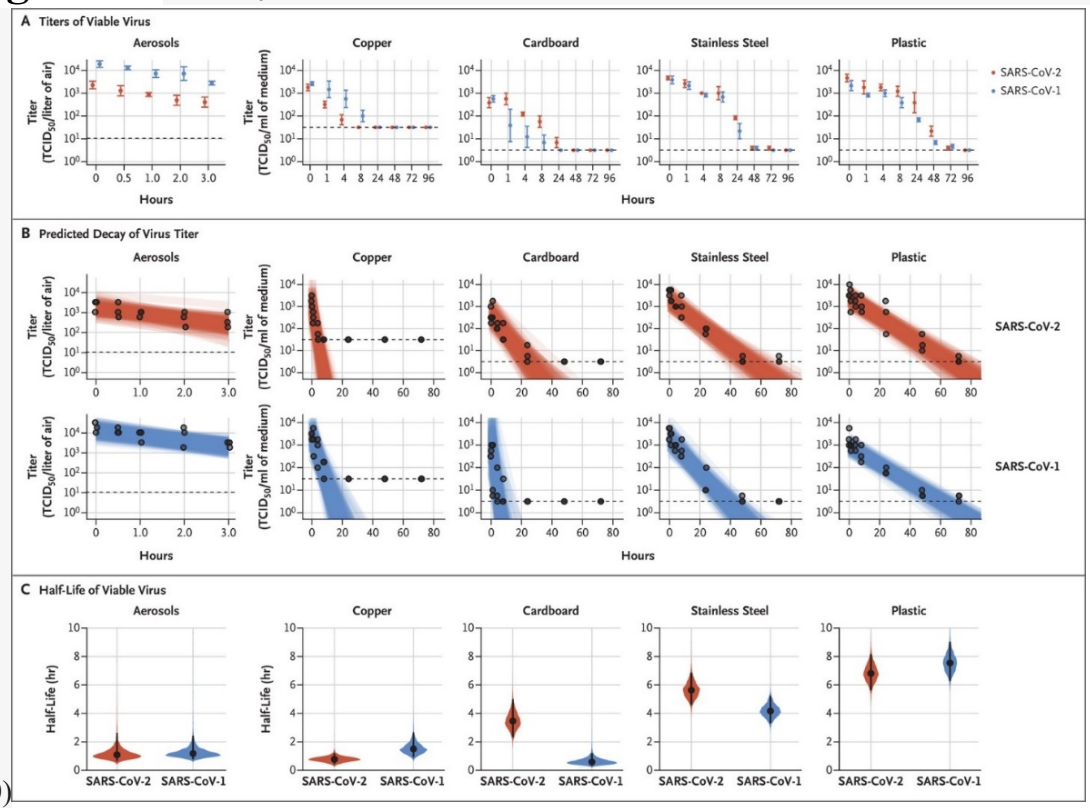
"SARS-CoV-2 was more stable on plastic and stainless steel than on copper and cardboard, and viable virus was detected up to 72 hours after application to these surfaces (Fig. 1A), although the virus titer was greatly reduced (from 103.7 to 100.6 TCID50 per milliliter of medium after 72 hours on plastic and from 103.7 to 100.6 TCID50 per milliliter after 48 hours on stainless steel). The stability kinetics of SARS-CoV-1 were similar (from 103.4 to 100.7 TCID50 per milliliter after 72 hours on plastic and from 103.6 to 100.6 TCID50 per milliliter after 48 hours on stainless steel). On copper, no viable SARS-CoV-2 was measured after 4 hours and no viable SARS-CoV-1 was measured after 8 hours. On cardboard, no viable SARS-CoV-2 was measured after 24 hours and no viable SARS-CoV-1 was measured after 8 hours (Fig. 1A)." (10)

From the NIH:

"The results provide key information about the stability of SARS-CoV-2, which causes COVID-19 disease, and suggests that people may acquire the virus through the air and after touching contaminated objects. The study information was widely shared during the past two weeks after the researchers placed the contents on a preprint server to quickly share their data with colleagues." (3)

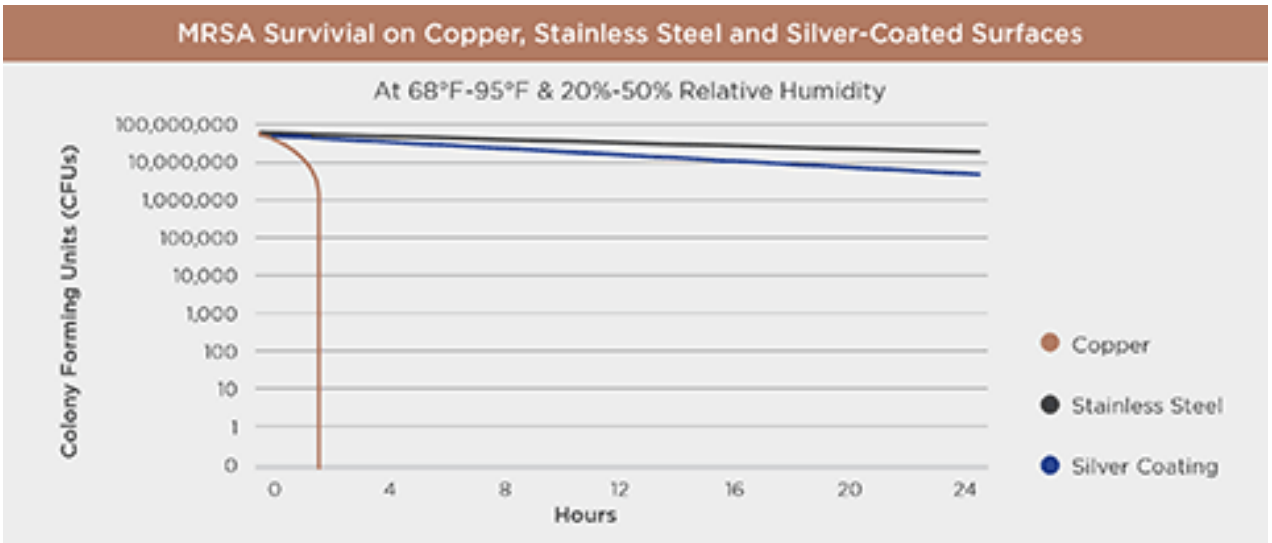
"In contrast to SARS-CoV-1, most secondary cases of virus transmission of SARS-CoV-2 appear to be occurring in community settings rather than healthcare settings. However, healthcare settings are also vulnerable to the introduction and spread of SARS-CoV-2, and the stability of SARS-CoV-2 in aerosols and on surfaces likely contributes to transmission of the virus in healthcare settings." (3)

Figure 2: **Viability of SARS-CoV-1 and SARS-CoV-2 in Aerosols and on Various Surfaces**



(10)

Figure 3. MRSA Survival on Copper, Stainless Steel and Silver-Coated Surfaces



IN-HOSPITAL ICU RESEARCH ON COPPER VS BACTERIA AND HAIs.

"A multihospital clinical trial was conducted in the Medical Intensive Care Units (ICUs) of three hospitals: Memorial Sloan Kettering Cancer Center, in New York City, NY; Medical University of South Carolina, in Charleston, SC; and Ralph H. Johnson Veterans Administration Medical Center, Charleston, SC. Each hospital's institutional review board for the conduct of studies involving human subjects, as well as the U.S. Army's Office of Risk Protection, approved the study as was indicated in the initial publications of the clinical trial results." (1)

Description of results from the clinical trials research at the three hospitals:

"RESULTS. The rate of HAI and/or MRSA or VRE colonization in ICU rooms with copper alloy surfaces was significantly lower than that in standard ICU rooms (0.071 vs 0.123). For HAI Pp.020 only, the rate was reduced from 0.081 to 0.034 (Pp.013).
CONCLUSIONS. Patients cared for in ICU rooms with copper alloy surfaces had a significantly lower rate of incident HAI and/or colonization with MRSA or VRE than did patients treated in standard rooms." (11)

"Results:

Greater than a 99.9% reduction in live bacteria was realized in laboratory tests. In the clinical trials, an 83% reduction in bacteria was seen on the copper alloy components, when compared to the surfaces made from standard materials in the control rooms. Finally, the infection rates were found to be reduced by 58% in patient rooms with components made of copper, when compared to patients' rooms with components made of standard materials." (1)

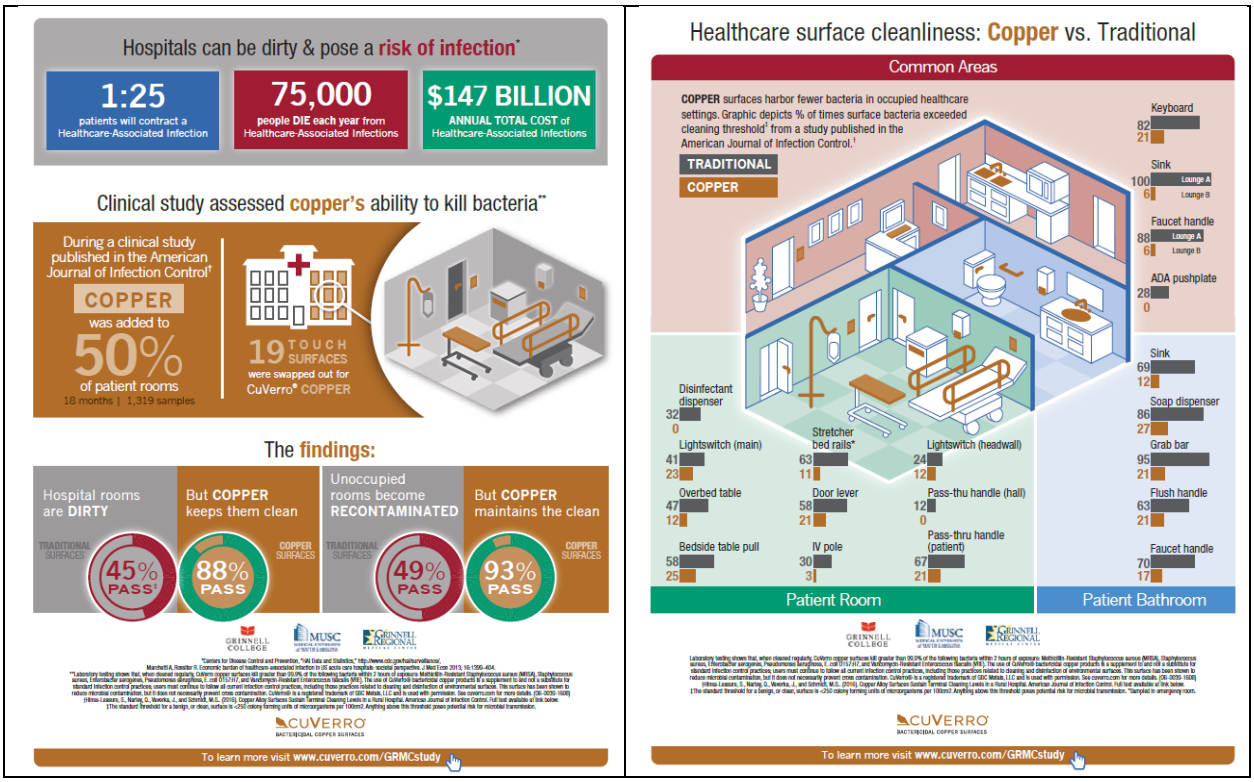
GRINNELL REGIONAL MEDICAL CENTER STUDY.

Grinnell Regional Medical Center conducted a study in which it replaced commonly touched traditional surfaces such as door handles, bed rails, and grab bars with copper alloy products into patient rooms. The study established a standard of 250 CFU/cm2 threshold concentration recommended for at-risk components immediately upon completion of terminal cleaning. (12)

The study found that, in occupied rooms, 55% of traditional surfaces exceeded the 250 CFU/cm2 level of risk while only 12% of copper alloy surfaces exceeded the 250 CFU/cm2 level of risk. (12)

In unoccupied rooms, 51% of traditional surfaces exceeded the 250 CFU/cm2 level of risk while only 7% of copper alloy surfaces exceeded the 250 CFU/cm2 level of risk. (12)

Figure 4. Infographics summarizing Grinnell Regional Medical Center Study



RESEARCH ON COPPER AND INFLUENZA A.

The following summarizes research on the inactivation of Influenza A Virus on copper versus stainless steel:

"Influenza A virus particles (2 x 10^6) were inoculated onto copper or stainless steel and incubated at 22°C at 50 to 60% relative humidity. Infectivity of survivors was determined by utilizing a defined monolayer with fluorescent microscopy analysis. After incubation for 24 h on stainless steel, 500,000 virus particles were still infectious. After incubation for 6 h on copper, only 500 particles were active."

However, the current study shows that copper surfaces may contribute to the number of control barriers able to reduce transmission of the virus, particularly in facilities, such as schools and health care units, where viral contamination has the ability to cause serious infection. (13)

Figure 5: Effect on influenza A virus infectivity after a 6-h or 24-h exposure to stainless steel. (13)

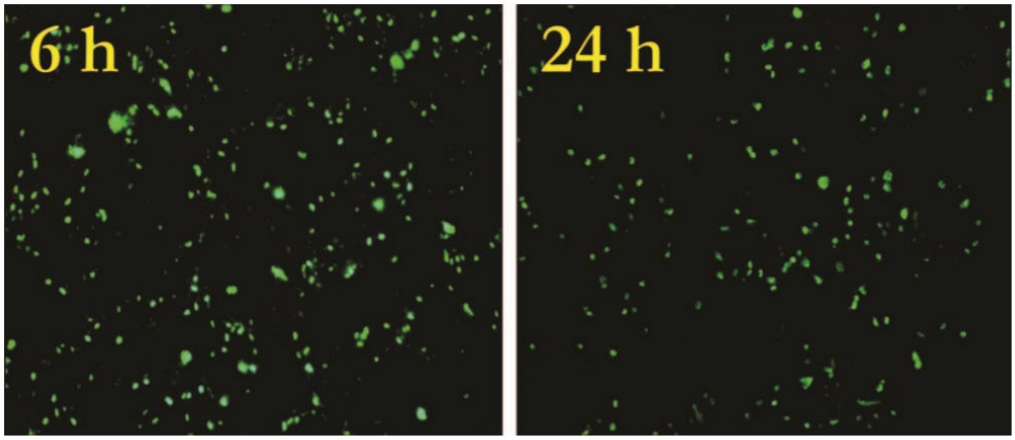


FIG. 2. Effect on influenza A virus infectivity after a 6-h or 24-h exposure to stainless steel.

Figure 6: Effect on influenza A virus infectivity after a 60-min or 6-h exposure to copper (13)

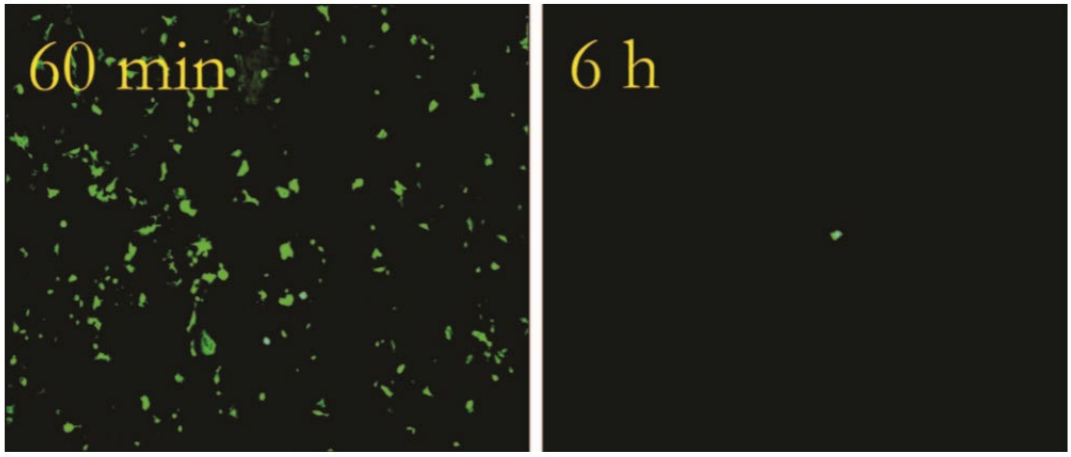


FIG. 3. Effect on influenza A virus infectivity after a 60-min or 6-h exposure to copper C11000.

RECENT GOVERNMENT LEGISLATION REGARDING COPPER ALLOY

The New York State Senate has proposed a new bill (S8180) that would "require the use of an antimicrobial copper alloy for touch surfaces in new construction." (14)

The stated purpose of the bill is: "To require the use of an antimicrobial copper alloy that is recognized by the US environmental Protection Agency for touch surfaces in new, publicly funded construction projects in order to reduce the presence of disease-causing bacteria, viruses, and yeasts on commonly used touch surfaces and therefore protect public health." (14)

See Exhibit C for a copy of the proposed New York State Senate Bill.

TESTIMONIALS

"Incorporating new technology shows our commitment to providing a safe environment for patient care," said **Director of Infection Prevention and Control Sarah Bishop, A.P.R.N., at UofL Hospital**. "I'm proud to work for an organization that is an early adopter of these emerging technologies." The new technologies are CuVerro (Healthy Hardware) Bactericidal Copper Surfaces…" (5)

"HAIs can happen in any health care facility," said **university of Louisville Hospital Chief Medical Officer Jason Smith, M.D., Ph.D**., including hospitals, ambulatory surgical centers, long-term care facilities and others. "They are caused by bacteria, fungi, viruses or other less common pathogens. The new systems (Healthy Hardware and other CuVerro copper alloy touch surfaces) installed at UofL Hospital will have a significant impact in reducing the incidence of HAIs." (6)

"**Ed Harrich, chief of surgical services (Pullman Regional Hospital)**, and his staff have been methodically installing the hardware [copper alloy]. He persuaded hospital administrators to approve another $10,000 for more items. "If you looked at my cabinet pulls, they look like stainless steel, but we still get copper's killing properties," he said. "We're still continuing to clean everything we can. But this is our little helper behind the scenes." (7)

"We've known for a long time that copper and other metals are effective in killing microbes, so it wasn't a great leap to incorporate copper surfaces into hospitals," said **John Lynch, medical director of infection control at Harborview Medical Center** in Seattle, which is redesigning a waste-disposal room to incorporate copper on light switches and door handles. (7)

Figure 7. Excerpt from Lexington Medical Center's Official Blog:

Lexington Medical Center
OFFICIAL BLOG

BACK TO LEXMED.COM »

Coronavirus — Latest on COVID-19
LMC People — Our Dedicated Staff
Technology — Cutting-edge Healthcare
Events — What's On @ LMC
Videos — Podcasts and Media
Every Woman Blog — A Blog for Women by Women

The New Tower: Copper

MARCH 28, 2019 0 COMMENTS

This post is part of a blog series about the features of our new patient care tower. The 545,000 square foot project is the largest hospital expansion in South Carolina history. The 10-story tower is the new home of the Mother/Baby department, eight operating rooms, six floors for surgical, obstetric, ICU and oncology patients, enhanced dining options, a spacious atrium, educational space and a serenity garden.

Inside our new patient care tower, we want to make sure we reduce the risk of infection and spread of germs as much as possible.

One way we've worked toward that goal is to cover all "high touch" areas including door knobs, handles, toilet flushers, IV poles and sink poles. Research has shown that copper can destroy germs and reduce the risk of disease.

Germs on a laminated over-bed table can be there two hours later. But germs on a copper surface will naturally die because copper provides much less opportunity to transfer infection.

Search

Enter keywords...

Recent Comments

- jenniferawilson on Thank You, Swamp Foxes!
- jenniferawilson on Welcome Dr. Steven Marra, Heart Surgeon
- jenniferawilson on Introducing Lexington Medical Center Northeast
- Kimberly Thompson on Introducing Lexington Medical Center Northeast
- Jane West on Welcome Dr. Steven Marra, Heart Surgeon

Posts Calendar

"It's [Healthy Hardware] always working, it requires no human intervention, no supervision, and it's acting continuously," said **Michael Schmidt, a microbiology professor at the Medical University of South Carolina** and one of the researchers who conducted the first and largest study of copper surfaces in hospitals. (7)

"It's [Healthy Hardware] such an elegant solution to help support improving the cleanliness of hospitals, because it cleans 24/7," said **Todd Linden, Grinnell's CEO**. "You don't have to teach it how to wash its hands." (8)

COMMUNICATING HEALTHY HARDWARE IN THE HOSPITAL.

Figure 8. Healthy Hardware Signage Example

HEALTHY HARDWARE INSTALLATION PICTURES.

Figure 9. Parkview Health - Parkview Medical Center - Indiana

Figure 10. Lexington Medical Center – South Carolina

WHAT DOES HEALTHY HARDWARE LOOK LIKE?

Healthy Hardware looks like stainless steel or brushed nickel.

HOW TO CLEAN HEALTHY HARDWARE?

See Exhibit B for cleaning instructions. The Hospital will be able to continue its standard cleaning practices and will not have to make modifications.

References

1. *From Laboratory Research to a Clinical Trial.* **Harold T. Michels, MS, PhD, PE,1 C. William Keevil, PhD,2 Cassandra D. Salgado, MD, MS, FIDSA, FSHEA,3 and Michael G. Schmidt, MA, PhD3.** s.l. : SAGE, 2015.

2. **CUVERRO.** EPA Registration & Tests. *CUVERRO BACTERICIDAL COPPER SURFACES.* [Online] CUVERRO, 2020. [Cited: JULY 27, 2020.] https://cuverro.com/epa-registration-tests.

3. **New coronavirus stable for hours on surfaces. *National Institutes of Health.* [Online] March 17, 2020. [Cited: July 27, 2020.] https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces.**

4. How COVID-19 Spreads. *CDC Web Site.* [Online] Centers for Disease Control & Prevention, June 16, 2020. [Cited: 7 27, 2020.] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html.

5. Acting on and investing in the commitment to reduce patient infection. *University of Louisville Hospital.* [Online] July 30, 2020. https://www.uoflhospital.org/news/acting-and-investing-commitment-reduce-patient-infection.

6. CuVerro. CuVerro copper plays role in infection prevention in University of Louisville Hospital's Bone Marrow Transplantation Unit. *cuverro.com.* [Online] December 1, 2017. [Cited: July 29, 2020.] https://cuverro.com/about-cuverro/news/cuverro-copper-plays-role-infection-prevention-university-louisville-hospital's.

7. Sun, Author Lena H. Hospitals' new 'little helper' in killing bacteria: copper surfaces . *NCHI NEWS.* [Online] Washington Post, 9 22, 2015. [Cited: July 29, 2020.] https://www.cnhinews.com/article_d25f8544-60bc-11e5-b4ff-0f2edc184366.html.

8. Whitman, Elizabeth. Best Practices: Using copper to fight infections. *Modernhealthcare.com.* [Online] November 5, 2016. [Cited: July 30, 2020.] https://www.modernhealthcare.com/article/20161105/MAGAZINE/311059997/best-practices-using-copper-to-fight-infections.

9. Copper Development Association, Inc. CDA . *CDA's Position on Coronavirus (COVID-19) and Copper's Antimicrobial Properties.* [Online] April 2020. [Cited: July 28, 2020.] http://www.magnetmail.net/actions/email_web_version.cfm?ep=jOg50leOn8o_Adv9Ru0YJb7LnOy12k3rRoPx5YyffTO9J4DiyDSHoN3nI3NUNkZvJaOLjCkdtYtKQqBgGWyxGOzUMLjJkRMwZYWrbO2PskObZvJodzovpWtMvedIQ44x.

10. *Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1.* N van Doremalen, et al. s.l. : The New England Journal of Medicine, 2020.

11. *Copper Surfaces Reduce the Rate of Healthcare-Acquired Infections in the Intensive Care Unit.* Cassandra D. Salgado MD, Kent A. Sepkowitz MD, Joseph F. John MD, J. Robert Cantey MD, Hubert H. Attaway MS, Katherine D. Freeman DrPH, Peter A. Sharpe MBA, Harold T. Michels PhD and Michael G. Schmidt PhD. 2013, The Society for Healthcare Epidemiology of America, p. 2.

12. Shannon M. Hinsa-Leasure, PhD, Michael G. Schmidt, PhD, Justin Vaverka, BA, Queenster Nartey, BA. Copper alloy surfaces sustain terminal cleaning levels in a rural hospital. *American Journal of Infection Control.* [Online] November 1, 2016. [Cited: July 30, 2020.] https://www.ajicjournal.org/article/S0196-6553(16)30751-9/fulltext.

13. *Inactivation of Influenza A Virus on Copper versus Stainless Steel Surfaces.* J. O. Noyce, H. Michels, and C. W. Keevil. 8, s.l. : APPLIED AND ENVIRONMENTAL MICROBIOLOGY, 2006, Vol. 73.

14. New York State Senate. www.nysenate.gov. *Senate Bill S8180.* [Online] April 13, 2020. [Cited: August 3, 2020.] https://www.nysenate.gov/legislation/bills/2019/s8180.

15. New coronavirus stable for hours on surfaces. *National Institutes of Health Web Site.* [Online] March 17, 2020. [Cited: July 28, 2020.] https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces.

EXHIBIT A – HEALTHY HARDWARE / CUVERRO RECOMMENDED CLEANING INSTRUCTIONS

The visual appearance of CuVerro® with regular cleaning

Kelly Funke*

Abstract

The visual appearance of CuVerro® alloys that are cleaned daily is influenced by the type of cleaner used. A four-week cleaning study compared visual changes amongst various hospital cleaners on brushed samples of CuVerro® Rose, CuVerro® White Bronze, and pure copper. Hydrogen peroxide based cleaner, *Clorox Healthcare™ Hydrogen Peroxide*, resulted in clean bright appearances on all surfaces over the course of the study. When cleaned daily with this cleaner, surfaces looked as bright as or brighter than a control surface not cleaned over the duration of the test. The alloys also exhibited little or no discoloration with *70% Isopropyl Alcohol Wipes* and standard quaternary ammonium based cleaner, *Virex® II*. Conversely, CuVerro® and pure copper showed a darkening over time when cleaned with hypochlorite based cleaner, *Dispatch®*, on a daily basis. The alloys responded similarly to citric acid based cleaner, *CleanCide®*, becoming discolored and etched appearing though this depended on the drying method. An alcohol quat based cleaner, *PDI Super Sani-Cloth®*, also caused discoloration but not to the level of hypochlorite and citric acid cleaners. The study also found that, over the course of the evaluation, pure copper surfaces darkened more than CuVerro® surfaces.

Introduction

CuVerro® is a class of copper-based alloys that continuously kill bacteria[1] associated with healthcare-acquired infections. These surfaces represent the only class of EPA-registered solid surface materials that actively kill bacteria. CuVerro® is suited for commonly touched surfaces where transmitting infections are a concern. In healthcare, education, hospitality, and other public spaces, CuVerro® touch surfaces can complement routine cleaning and infection control practices to help keep the built environment continuously clean between cleanings.

Touch surfaces benefitting from CuVerro® are inherently visible surfaces. Routine cleaning should leave these surfaces appearing clean and visually appealing. Because CuVerro® alloys have actively exposed copper, the relationship between cleaning and visual appeal is an important aspect in the choice of cleaners for CuVerro®. This study evaluated the compatibility of six standard hospital cleaners with CuVerro® from the perspective of visual appearance with routine cleaning.

[1] Laboratory testing shows that, when cleaned regularly, CuVerro® kills greater than 99.9% of the following bacteria within 2 hours of exposure: VRE, MRSA, Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa, and E. coli O157:H7. CuVerro® surfaces are a supplement to and not a substitute for standard infection control practices and have been shown to reduce microbial contamination, but do not necessarily prevent cross contamination; users must continue to follow all current infection control practices.

* Correspondence: kelly.funke@olinbrass.com
GBC Metals, LLC, 427 North Shamrock Street, East Alton, IL, 62024-1197, USA

Method

Four-inch square coupons of CuVerro® Rose-C706, CuVerro® White Bronze-C710, and pure copper-C110 were used. The test surface of each coupon was freshly brushed at the immediate start of the study by unidirectional abrasion with red Scotch-Brite® (Type A VFN aluminum oxide).

Photographs were taken of the coupons to represent their actual appearance. In addition to photographs, visual observations were made. One coupon of each alloy served as a control; it sat near the test coupons and was not cleaned.

The test coupons were cleaned individually in the afternoon of each weekday using one of six different hospital disinfectant cleaners. The cleaners are shown in Table 1. Pre-moistened disposable wipes were available and used for all cleaners except Virex® II. The Virex® II cleaner was prepared from a 256:1 concentrate because wipes were not available. The Virex® II was applied by spraying a microfiber cloth which was used to wipe the test coupons; the cloth was rinsed with water and air dried after each day of cleaning.

Cleaning was done following each manufacturer's

Table 1. Standard hospital cleaners used in daily cleaning study

1) Quaternary ammonium compound (QAC); *Virex® II*, 10 min contact time, label directions state "Wipe surfaces and let air dry."
2) Hypochlorite (ClO-); *Dispatch® Hospital Cleaner Disinfectant Towels with Bleach*, 2 min contact time, label directions state "Wipe dry or allow to air dry."
3) Hydrogen peroxide (HP); *Clorox HealthcareTM Hydrogen Peroxide Cleaner Disinfectant Wipes*, 5 min contact time, label directions state "Let air dry."
4) Citric acid (CA); Wexford Labs *CleanCide®*, 10 min contact time, label directions state "Wipe or let air dry."
5) Alcohol/quaternary ammonium compound (A/QAC); *PDI Super Sani-Cloth® Germicidal Disposable Wipes*, 2 min contact time, label directions state "Let air dry."
6) Isopropyl alcohol (IPA); *Walgreens Isopropyl Alcohol Wipes 70%*, 15 sec contact time, no label directions for disinfecting hard surfaces

label instructions. The wet contact time used for each cleaner is given in Table 1. The label instruction for the drying method of some cleaners specified air-dry while for others it specified wipe-dry *or* air-dry, as seen in Table 1. In this study, both types of drying method were used for each cleaner. With the air-dry method, coupons were allowed to air dry in ambient room atmosphere after the wet contact time had been achieved. With the wipe-dry method, coupons were wiped dry with a clean paper towel after the wet contact time had been achieved.

Results & Discussion

Photos of the test coupons after four weeks of cleaning are shown in Figs. 1 and 2 relative to the controls at four weeks. Fig. 1 shows results for air-dry and Fig. 2 shows results for wipe-dry. Visual observations of the test coupons relative to the controls are given in Tables 2 and 3 below the accompanying figures.

With the air-dry method, there were observations of various colors of stains ranging from white, gray, brown, to black. These stains were from the cleaners evaporating on the surface, leaving behind what appeared to be residue spotting. In most cases, these cleaned off with the next day's cleaning.

Notably, the surface area of the test coupons was small relative to the amount of liquid in the pre-moistened wipes or saturated cloth with each day's cleaning; because of this, there was a liberal amount of cleaner on each coupon, likely much more than would be on surfaces in a real housekeeping setting. Residues were not seen with the wipe-dry method. This suggests the amount of residual liquid left on the surface after cleaning affects appearance.

The residue effect was especially evident with Clorox Hydrogen Peroxide and Dispatch®. Residual liquid of these cleaners in the air-dry method left an evident white film on the surface. With the wipe-dry method, where there was no visible residual liquid, the surfaces cleaned with these cleaners took on different appearances. The wipe-dry Clorox Hydrogen Peroxide surface was clean and bright – brighter than the control and appearing to be a fresh surface. The wipe-dry Dispatch® surface had a dark brown oxidized appearance.

Citric acid cleaner, CleanCide®, had a particularly aggressive effect on pure copper. Used as air-dry or wipe-dry, this cleaner turned pure copper dark and created an etched matte appearance. With CuVerro®, however, this cleaner exhibited a much less aggressive effect and surfaces appeared brighter when used as wipe-dry – in fact, for the higher nickel content CuVerro® White Bronze-C710, this cleaner produced a clean bright surface when used as wipe-dry.

The visual changes that arose over time with any of the cleaners were less pronounced for CuVerro® than pure copper. However, rankings of cleaners based on relative brightness and discoloration for each alloy were generally the same for CuVerro® as pure copper.

The cleaners that produced the brightest surfaces with the least observed color change were Clorox Hydrogen Peroxide, 70% Isopropyl Alcohol, and Virex® II. The cleaners that produced the darkest surfaces with the most observed color change were Dispatch® and CleanCide®. Super Sani-Cloth® produced results between the two extremes.

Rankings of the cleaners based on brightness and discoloration are shown in Table 4 for each alloy and method of drying.

Conclusions

Regular cleaning with hydrogen peroxide based cleaner, such as Clorox Hydrogen Peroxide, keeps CuVerro® looking clean and bright. Other cleaners that keep CuVerro® looking clean with regular cleaning are 70% Isopropyl Alcohol and quat based cleaner, Virex® II. An alcohol quat cleaner, such as Super Sani-Cloth®, maintains a clean appearance with some darkening over time.

Hypochlorite based cleaner, Dispatch®, and citric acid based cleaner, CleanCide®, cause darkening and discoloration of CuVerro® with regular cleaning. The effect of citric acid cleaner depends upon the

method of drying, however, as it actually produces a clean bright surface on CuVerro® White Bronze when used as wipe-dry.

The amount of residual liquid left on the surface after cleaning affects appearance. Cleaners left on the surface to air dry can leave a film and cause residue spotting.

Pure copper is more sensitive to cleaners that cause darkening and discoloration than CuVerro®. Cleaners that cause darkening and discoloration of pure copper do so to a much lesser degree with CuVerro®. Overall, the degree of discoloration with CuVerro® is subtle relative to pure copper.

Author details
Kelly Funke is a Principal Research Scientist for GBC Metals, LLC, a subsidiary of Global Brass and Copper, Inc.

Fig. 1 – Photo results after four weeks with air-dry

Table 2. Observations relative to control at four weeks for air-dry

Cleaner \ Alloy	C110	C706	C710
Clorox Hydrogen Peroxide (HP)	Color is a little brighter but has white and brown stains.	Color is good but white stains.	Color behind white stains same as control.
Isopropyl Alcohol (IPA)	Slightly darker.	Same as control; small dark spots.	Same as control.
Virex® II (QAC)	Brown stains.	Color behind white grayish stain is same as control.	Slightly darker color with gray/white stains.
Super Sani-Cloth® (A/QAC)	More orange color with greenish black stains.	Slightly darker; light gray stains.	Dark gray stains; color behind same as control.
CleanCide® (CA)	Much darker with grayish black stains.	Darker with dark gray stains.	Slightly darker gray stains.
Dispatch® (ClO-)	Darker with white spots and brown and black stains.	Slightly darker with white spots.	Darker with white spots.

Fig. 2 – Photo results after four weeks with wipe-dry

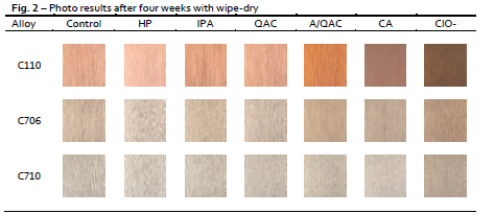


Table 3. Observations relative to control at four weeks for wipe-dry

Cleaner \ Alloy	C110	C706	C710
Clorox Hydrogen Peroxide (HP)	Much brighter.	Slightly brighter.	Same as control.
Isopropyl Alcohol (IPA)	Slightly darker small brown stains.	Same as control.	Same as control.
Virex® II (QAC)	Slightly darker.	Same as control.	Same as control.
Super Sani-Cloth® (A/QAC)	Orange color.	Slightly darker.	Same as control but with brown stains.
CleanCide® (CA)	Darker with black spots.	Slightly darker; dull appearance with black stains.	Same as control.
Dispatch® (ClO-)	Brown color with black stains.	Darker with brown stains	Darker.

Table 4. Ranking of cleaners based on brightness and discoloration

	C110	C706	C710
		Air-dry	
Brightest/ Least darkening	HP	HP	IPA
	IPA	IPA	HP
	A/QAC	QAC	QAC
	QAC	A/QAC	A/QAC
Darkest/ Most darkening	ClO-	ClO-	CA
	CA	CA	ClO-
		Wipe-dry	
Brightest/ Least darkening	HP	HP	HP
	QAC	QAC	CA
	IPA	IPA	IPA
	A/QAC	A/QAC	QAC
Darkest/ Most darkening	CA	CA	A/QAC
	ClO-	ClO-	ClO-

Abbreviations: HP = hydrogen peroxide, IPA = isopropyl alcohol, QAC = quaternary ammonium compound, A/QAC = alcohol quat, CA = citric acid, and ClO- = hypochlorite.

Exhibit B. NEW YORK STATE BILL S8180

STATE OF NEW YORK

8180

IN SENATE

April 13, 2020

Introduced by Sen. KENNEDY -- read twice and ordered printed, and when printed to be committed to the Committee on Labor

AN ACT to amend the labor law, in relation to requiring the use of an antimicrobial copper alloy for touch surfaces in new construction

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

1 Section 1. The labor law is amended by adding a new section 241-c to
2 read as follows:
3 § 241-c. New construction; solid antimicrobial copper alloy. 1. Any
4 publicly funded construction shall include touch surfaces made from
5 solid antimicrobial copper alloy.
6 2. As used in this section:
7 a. "Solid antimicrobial copper alloy" shall mean a solid copper alloy
8 that:
9 (i) is listed under United States environmental protection agency
10 registration number 82012-1, 82012-2, 82012-3, 82012-4, 82012-5, or
11 82012-6, or is otherwise identified by a unified numbering system code
12 in an environmental protection agency registration;
13 (ii) has a copper content of not less than sixty weight percent; and
14 (iii) has a content of not more than one-tenth weight percent of each
15 of the following: lead, chromium, and arsenic.
16 b. "Touch surface" shall mean any surface or fixture within a building
17 that a person frequently comes into contact with including but not
18 limited to: door handles, bathroom fixtures, bed rails, handrails and
19 light switches.
20 § 2. This act shall take effect on the sixtieth day after it shall
21 have become a law.

EXPLANATION--Matter in *italics* (underscored) is new; matter in brackets [-] is old law to be omitted.

LBD16057-01-0