



Welcome

EVOLUTION OF VINYL FLOORING

Presented by: F2C Design Group

2020



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Thank you!





The Evolution of Vinyl Flooring -
Then and Now program has been
approved by the IDCEC and
entitles the attendee to 1 CEU
credit. The course number is 0000.

Thank you!

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Learning Objectives



To provide a history of how Vinyl Flooring has evolved and improved over the last 50 years.



To inform architects, specifiers, designers and end-users of third-party-tested features and benefits of Vinyl Flooring.



To show how Vinyl Flooring has addressed current day environmental issues by offering value-enhanced properties and capabilities.



Show the benefits of a variety of vinyl products to meet different architectural goals successfully.

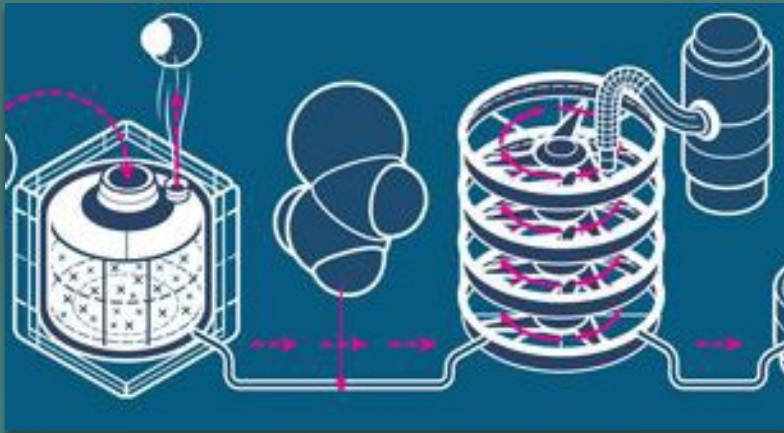
A Brief History



- ▶ Vinyl is one of the oldest synthetic materials
- ▶ Discovered by a French physician in the 19th century.
- ▶ During the war years research focused on exploiting vinyl as an alternative to rubber.
- ▶ Industrial uses of vinyl began to multiply after the second world war.
- ▶ The 1950s marked an era of creativity and experimentation with this new material
- ▶ The 1960s it was being used as building materials, car components, food packaging, in medical equipment and even clothing.
- ▶ Also, in the 1960s is when companies in North America and Europe began to manufacture vinyl flooring.



Main Raw Materials in Vinyl Flooring

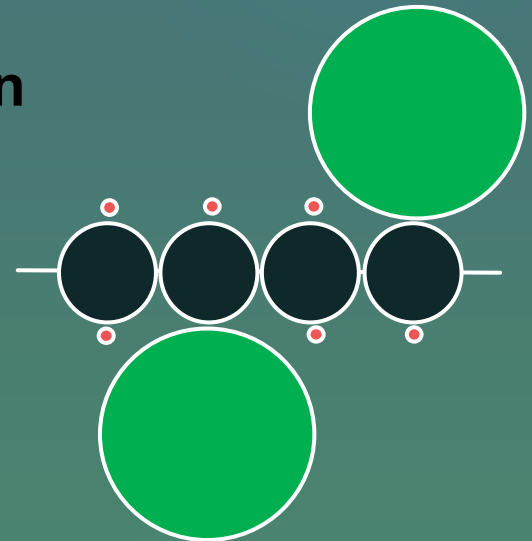
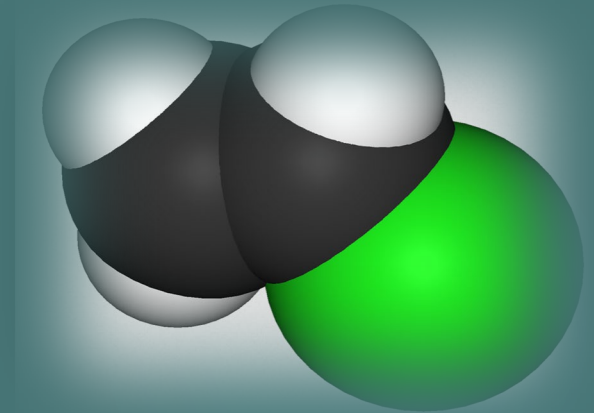
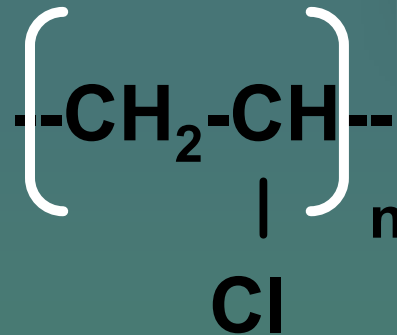


- ▶ PVC powder
- ▶ Plasticizer
- ▶ Stabilizers against heat and UV light
- ▶ Filler
- ▶ Foaming agent (in case of cushioned floor)
- ▶ Pigment
- ▶ Special additives - fire retardant agent, antifungi material

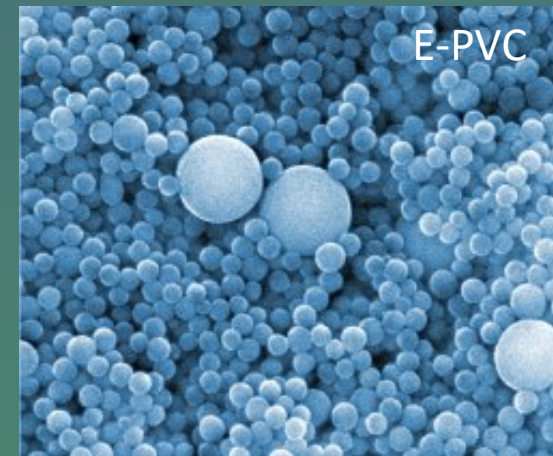
PVC = POLYVINYLCHLORIDE

Benefits of PVC/Vinyl

- Economic
- Can be modified easily
- Can be recycled
- Long life
- Resistance to various chemicals
- Good mechanical properties
- Easy to glue, can be welded
- Low carbon footprint



- **E-PVC** (emulsion PVC)
For coating processes
(heterogeneous vinyl floorings, LVT)
- **S-PVC** (suspension PVC)
For calendering and extrusion processes
(homogeneous floorings, LVT)



Function of plasticizers:

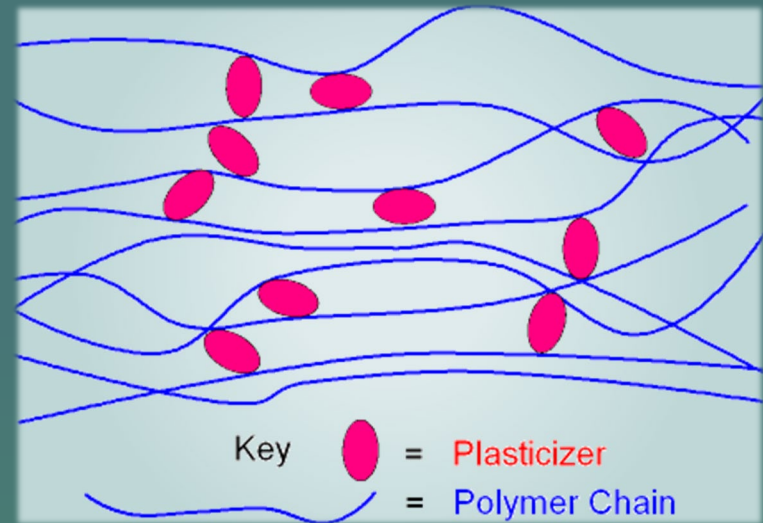
- ▶ When plasticizers are added to PVC at this stage, the plasticiser molecules make their way between the PVC molecules, this prevents the PVC polymer molecules from coming closer to each other.
- ▶ The polymer molecules are kept apart even at normal temperatures, so the softness is maintained. This is the role of plasticisers and such process is technically called plasticising.

Main types of Plasticizers:

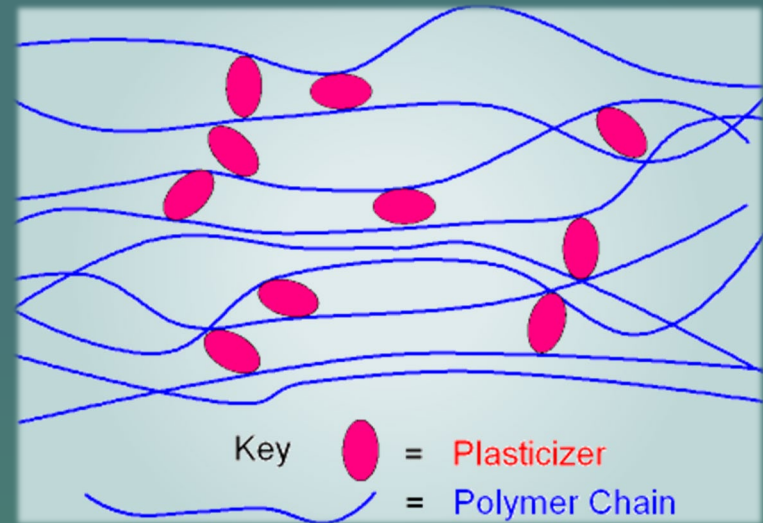
- ▶ Phthalates and Non-phthalates

Phthalates:

- ▶ 2 categories high and low phthalates
 - **High phthalates** (DINP, DIDP):
 - Risk assessments showed positive results regarding the safe use of this group of substances. They have all been registered under REACH (European Regulation), and do not require any classification for health and environmental effects



- **Low phthalates** (DEHP, DBP, DIBP and BBP):
 - Risk assessments have led to their classification and labelling as Category 1B Reproductive agents.
 - These four Low phthalates, (DEHP, DBP, DIBP and BBP), are now on the REACH Candidate List for Authorization. They have all been registered under REACH.
- ❖ **Most manufacturers do not use any low phthalates**
- **Non-phthalates plasticizers** (DOTP, ESBO, bio-based plasticizers) Are non-classified. They are not on the REACH candidate list, and are safe and healthy
- ❖ **Non-phthalate plasticizer is used in the manufacturing of most flooring**



STABILIZERS

- The use of stabilizers is essential to prevent the chain reaction of decomposition.
- Stabilizers can also enhance Vinyl/PVCs resistance to daylight, weathering and heat ageing.
- They have an important influence on the product's physical properties

[Lead-based systems are being voluntarily phased out within Europe and USA
under the Vinyl 2010/Vinyl Plus voluntary commitments of the PVC industry.**]**

FILLERS

- Mineral materials
- Cost cutting & modification of technical parameters

OTHER ADDITIVES

- Fire retardants, antibacterial chemicals, process aids, etc.

Health and Regulation



In 1990

The federal specification for LVT and Sheet Flooring did not address such issues as:

- ▶ **Washability**
- ▶ **Scrubability**
- ▶ **Stain Resistance**

Health Concerns Included:

- **Mercury & Cadmium, Heavy Metals in the material**
- **Solvent Based Inks used to print designs**
- **Recyclability was not a concern**
- **There were no tests or concerns for V.O.C. emissions**
- **Little or No Thought to Mold & Mildew Issues**

TODAY Who Regulates this



Code Of Federal Regulation And ASTM International:



- Washability
- Scrubability
- Recyclability
- Stain Resistance
- Heavy Metals removed / Improved Inks
- Infection Control Additives
- Mold and Mildew issues have been addressed
- Air Quality

Why is Indoor Air Quality (IAQ) Important?

- ▶ 90% of our time is spent indoors
- ▶ \$\$\$ needlessly lost / repetition of illness
- ▶ Inside Air Quality vs. Outside Air Quality
- ▶ Widespread Litigation - Insurance
- ▶ Most importantly people at Risk

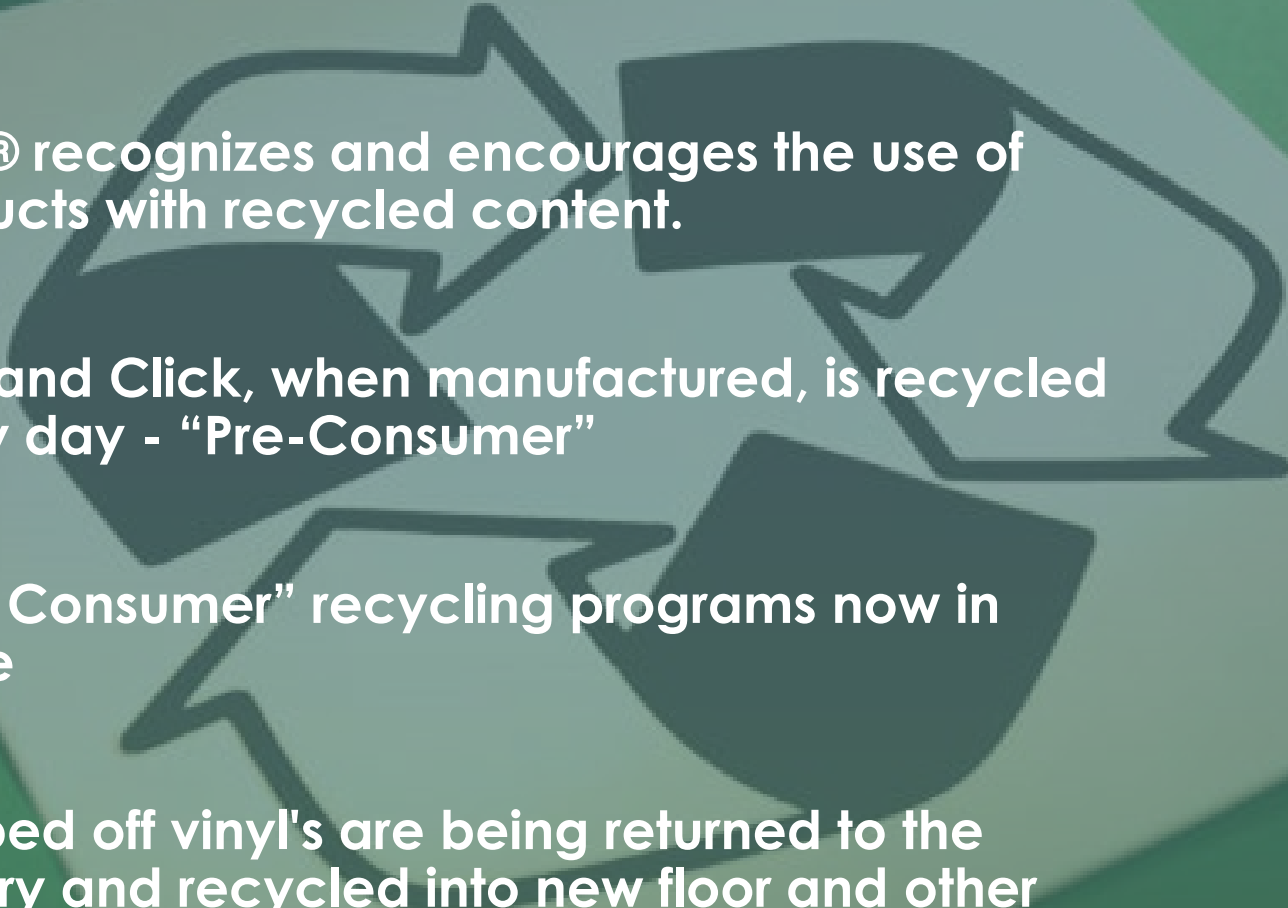


Proper Air Circulation, Ventilation & Source Control are Critical to Indoor Air Quality

- ▶ Healthier Options are Available to improve air quality and to help the overall environmental impact
- ▶ Potential LEED® Credits (Leadership in Energy & Environmental Design) are available helping to increase the projects overall score such as:
 - ▶ Products made within 500 mile distance
 - ▶ Low-emitting, air-quality-improving furnishings and products
 - ▶ Recycled vinyl flooring can support LEED® Credits under their Materials & Resources section



Recyclability

- 
- ▶ LEED® recognizes and encourages the use of products with recycled content.
 - ▶ LVT, and Click, when manufactured, is recycled every day - “Pre-Consumer”
 - ▶ “Post Consumer” recycling programs now in place
 - ▶ Stripped off vinyl's are being returned to the factory and recycled into new floor and other products

Independent, Third Party Testing



- ▶ Third party testing is most reliable
- ▶ Floor Score is just one of several agencies doing chamber testing
- ▶ Chamber tests confirm that most vinyl floorings comply to LEED® and California 1350 V.O.C. emissions.

Evolution of commercial flooring.



LINOLEUM DEVELOPED IN 1860. NATURAL BASED PRODUCT. DENTS EASILY AND OVER TIME IT YELLOWS AND DARKENS THROUGH A PROCESS CALLED AMBERING

RUBBER PATENTED IN 1894. STAINED AND DISCOLORED EASILY. NOT SUITABLE FOR AREAS OF HIGH MOISTURE.

ASPHALT TILE ARRIVES IN 1930 MADE FROM ASPHALT AND ASBESTOS. BECAUSE OF THE ASPHALT THESE TILES COULD ONLY BE MADE IN DARKER COLORS.

1933 **VCT** (VINYL COMPOSITE TILE) TILES ARRIVE ALSO CONTAINING ASBESTOS, BUT WITH BETTER COLOR OPTIONS THAN ASPHALT TILES. THEY ARE SUPER DURABLE AND INEXPENSIVE, BUT THEY HAD NO IDEA OF THE HEALTH IMPLICATIONS.

NEWER VERSIONS OF VCT WITHOUT ASBESTOS BECOME POPULAR IN THE 1980'S, DUE TO IT BEING INEXPENSIVE, DURABLE AND HAVING A WIDE RANGE OF COLORS, BUT LIMITED IN FORMAT. THEY ARE MOSTLY MADE OF LIMESTONE, FILLER AND COLOR CHIPS. THEY REQUIRE A LOT OF MAINTENANCE COSTING THE CLIENT EXCESSIVE MAINTENANCE EXPENSES.

Evolution of commercial flooring.



LVT AND SHEET VINYL WAS DEVELOPED IN THE MID 20TH CENTURY. DUE TO A LARGE RANGE OF DESIGNS, COLORS AND EASY INSTALLATION, LVT AND SHEET QUICKLY BECAME VERY POPULAR AND USER FRIENDLY.

SHEET VINYL OFFERS LARGE COLOR AND DESIGN OPTIONS. EASY TO MAINTAIN. GREAT FOR STATIC LOADS. FLASH COVING AND HEAT / COLD WELD OPTIONS FOR SEAMLESS FLOOR. INFECTION CONTROL, ODOR CONTROL, SLIP RESISTANCE, AND AN ARRAY OF APPLICATIONS. PARTICULARLY GOOD FOR HEALTH CARE AND EDUCATION.

LVT (LUXURY VINYL TILE) OFFERS COLOR AND DESIGN OPTIONS AS WELL. EASY TO MAINTAIN. GREATER STATIC LOADS THAN SHEET. INFECTION CONTROL, ODOR CONTROL, SLIP RESISTANCE, AND AN ARRAY OF APPLICATIONS. PARTICULARLY GOOD FOR RETAIL, HOSPITALITY, AND MULTI-HOUSING.

Benefits of Today's Vinyl

- ▶ Durability/Maintenance
- ▶ Stain Resistance
- ▶ Addresses Mold and Mildew Issues
- ▶ Post Consumer Recyclable
- ▶ Improved IAQ/Low VOC emissions
- ▶ Acoustical and Thermal Benefits
- ▶ Design and Color Options

Sheet Vinyl



- ▶ Seamless Flooring – heat weld, cold weld. Flash cove.
- ▶ Homogeneous
 - ▶ Regular
 - ▶ ESD
- ▶ Heterogeneous
 - ▶ P/U Protected
 - ▶ Silver Knight Infection Control Protected



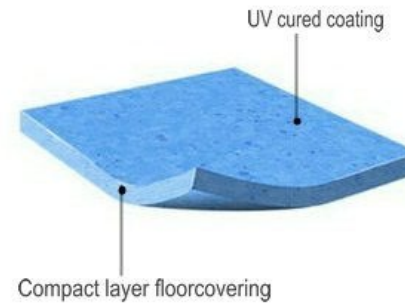
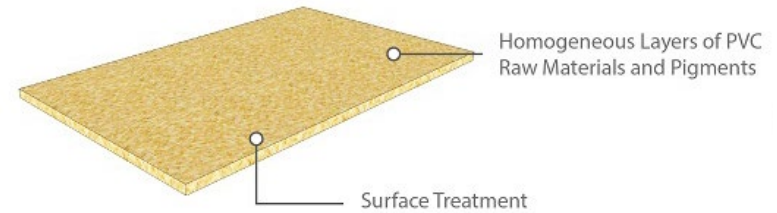
Homogenous Sheet Flooring

- ▶ Composed of a single layer of vinyl
- ▶ ESD is the same, but has added Electrostatic Conductive Properties
- ▶ Floors are glued to the sub-floor and welded together.
- ▶ Non-directional design
- ▶ Low residual indentation
- ▶ Long life expectancy
- ▶ Recommended for applications in healthcare and education due to their durability and ease of cleaning.



How Homogeneous Flooring Is Made

- ▶ Solid compact layer of pigmented vinyl
- ▶ UV Cured coating is added to the surface of the flooring to make the flooring anti-bacterial, mildew proof, improve stain resistance, and to help maintain the life and maintenance of the flooring.



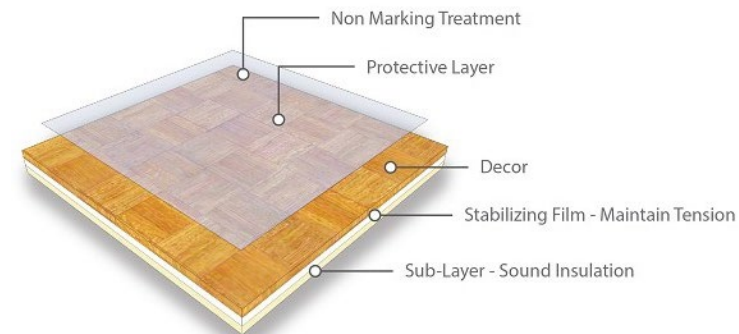
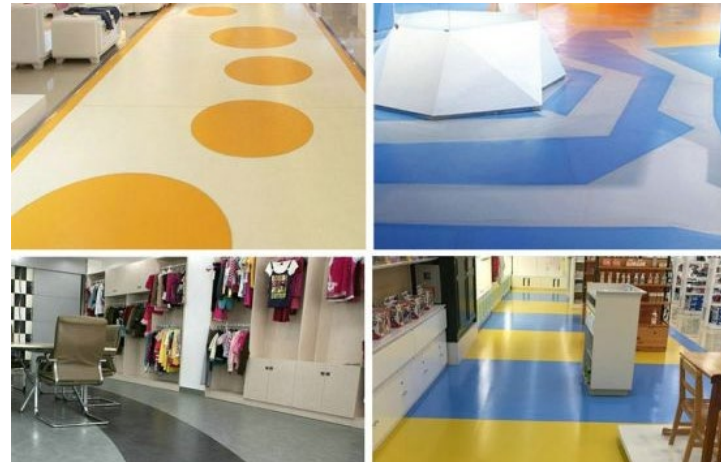
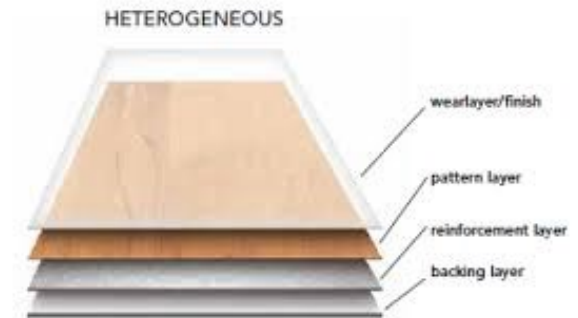
Heterogenous Sheet Flooring

- ▶ Multi-layer Vinyl flooring which comes in a wide variety of beautiful patterns with endless design possibilities.
- ▶ Floors are glued to the sub-floor and welded together.
- ▶ Can have a very high abrasion resistance
- ▶ Low residual indentation
- ▶ Added slip resistance
- ▶ Long life expectancy
- ▶ low maintenance cost, which is why it is the primary choice for health care facilities, schools, retail, offices etc.
- ▶ Can offer infection, stain and odor control. (Silver-nano and titanium dioxide)



How Heterogenous Sheet Is Made

- ▶ Multi-Layers fused together
- ▶ Sub layer for stability and sound insulation (sometimes composed of two layers)
- ▶ Print layer for pattern choice
- ▶ Protective wear layer
- ▶ Treatment infused in wear layer (ex: anti-bacterial, anti-microbial, stain resistance, mold resistance, etc)



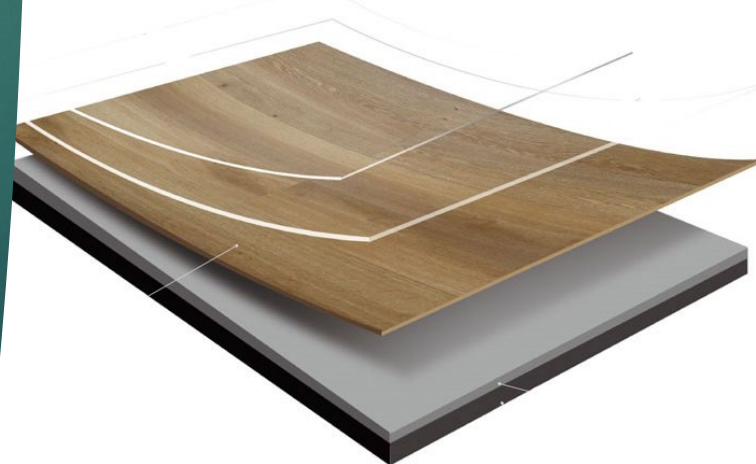
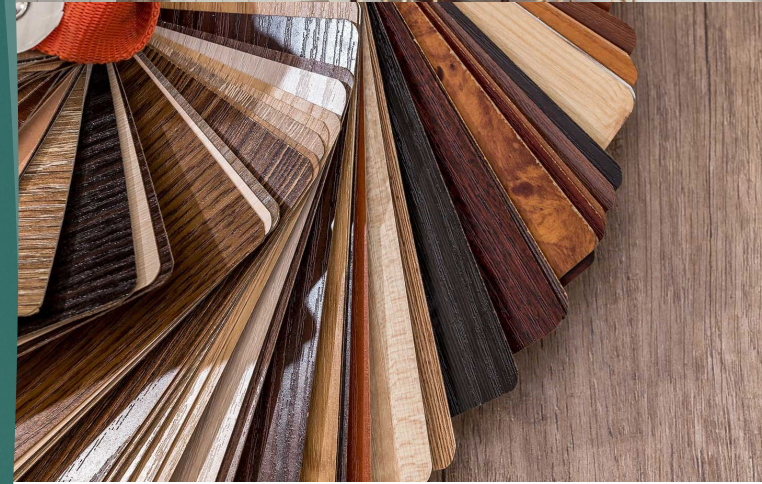
LVT (Luxury Vinyl Tile) Flooring

- ▶ High static and rolling load.
- ▶ Backings and adhesive resist high moisture.
- ▶ Offer a variety of install options.
- ▶ Endless pattern choices
- ▶ Cleanable
- ▶ Life-cycle advantage
- ▶ Flexibility in cleaning options. Can use buffing machines or can be no wax.
- ▶ Recommended for Hospitality, Multi-housing, Retail, Office spaces
- ▶ Can offer infection, stain and odor control. (Silver-nano and titanium dioxide)



How LVT (Luxury Vinyl Tile) Is Made

- ▶ Load-Bearing Vinyl base layer (stretched vinyl)
- ▶ Stabilization Vinyl layer (cross stretched vinyl, or fiberglass reinforced)
- ▶ Print film decoration layer
- ▶ Wear/Protection layer (transparent extremely dense, hard wearing surface layer)
- ▶ Surface treatment to wear/protection layer (ex: polyurethane treatment, UV treatment, Silver nano for antimicrobial protection)



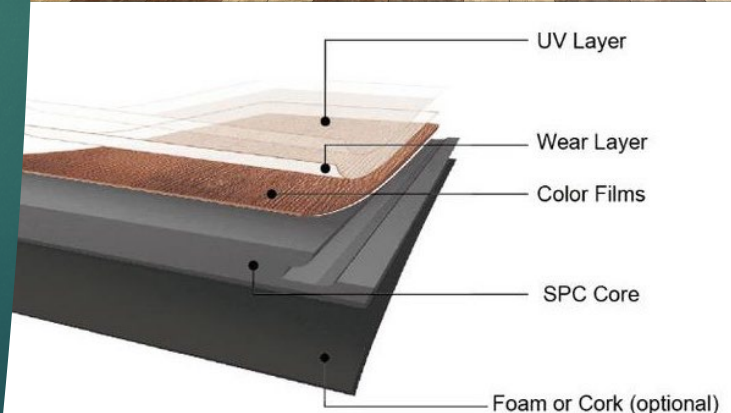
LVT Click Flooring

- ▶ Floating Floor System
- ▶ Sound absorbent
- ▶ “Hideability” – able to hide uneven sub straight
- ▶ Minimal floor preparation before install
- ▶ High static load limits
- ▶ Easily cleanable (buffable, wax, or no wax)
- ▶ 100% Waterproof
- ▶ Recommended for Light Commercial, Hospitality, Retail, and Multi-housing
- ▶ Can offer infection, stain and odor control (Silver-nano and titanium dioxide)



How LVT Click Is Made

- ▶ LVT Click consists of five layers:
 - ▶ Surface treatment to wear/protection layer (ex: polyurethane treatment, UV treatment, Silver nano for antimicrobial protection)
 - ▶ Wear/Protection layer (transparent extremely dense, hard wearing surface layer)
 - ▶ Print Film
 - ▶ Core (Vinyl, WPC, and SPC)
 - ▶ 1st Gen: All Vinyl very unstable
 - ▶ 2nd Gen: WPC (wood pulp Core) very stable, but water resistance issues because of wood pulp
 - ▶ 3rd Gen: SPC (Stone Particle Core) most stable, reliable and 100% waterproof
 - ▶ Foam, or Cork Backing



It is easy to change



Why Click Flooring?

Flooring Facts	VTB Quiet Plus	Glue Down LVT	Solid Locking LVT	Locking LVT with ordinary HDF core	Laminate
Fast and Easy to Install Without Acclimation	✓	✗	✗	✗	✗
Installs in Large Rooms Without Transition Strips	✓	✓	✗	✗	✗
Installs With Minimal Floor Prep	✓	✗	✗	✓	✓
Resists Water Without Damage to the Flooring	✓	✓	✓	✗	✗
Dimensionally Stable – Will Not Expand or Contract	✓	✓	✗	✗	✗
Adds Warmth to the Floor	✓	✗	✗	✗	✗
Resists Subfloor Mold and Mildew	✓	✗	✗	✗	✗
Reduces Noise – a Quieter Floor	✓	✗	✗	✗	✗
Hides Subfloor Imperfections	✓	✗	✗	✓	✓
Installs Over Existing Hard Surface Floors	✓	✗	✓	✓	✓

Infection Control



Healthcare design is getting **more** complex- challenges of economy with a reduction in hospital profits from reimbursements from Medicare, insured, underinsured

In order to **reduce HAI's** Medicare has stopped reimbursing facilities for HAI- facilities have to absorb the costs. Technology needs to improve and infection control is becoming a way to reduce costs and remain competitive.

What is an HAI?

Infections caught in a healthcare or hospital setting (HA-MRSA)

Estimated 2012 HAI costs were \$33 billion (CDC)

Most dangerous are: MRSA, VRE, C-diff, E-coli- klebsiella , ESBL o Patients at most risk have open wounds o Hospital surfaces may transfer the bacteria

Visitors can bring bacteria's/infections into the facility

Higher rates of infection in nursing homes or long term care facilities

What is a CAI? (CA-MRSA)

Community acquired Infections

More rapid spreading can be more severe than HA- MRSA

It is not known why some healthy people develop treatable infections why others with same strain are severe or die

At Risk populations: People with weakened immune, systems or chronic conditions, Young children, Elderly, Dorm living or other confined living situations: basic training, prison, locker rooms



Looking at healthcare surfaces it was found that –

27% of door handles have mssa=methicillian sensistive staphylococcus aurerus.

42% privacy curtains have VRA/22%.

MRSA Bacteria can survive 20-40 times longer on common surfaces without antimicrobial protection.

What can you do to protect your client?

Look at finishes that help prevent the spread of HAI/CAI.

Silver based solutions are - efficient, safe, versatile, cost-effective, less maintenance, use of less chemicals for cleaning.



Sustainability

ISO 14001, REACH conform, low VOC ,Floorscore, A+ labelling



THANK YOU FOR YOUR TIME!
This concludes our
Continuing Education Program

Questions???



Where is MRSA?

Living on coastal waters- MRSA is present in Florida, West Coast and Great Lakes.

Athletes and athletic facilities are prone to MRSA.

Society for Healthcare Epidemiology of America (SHEA) & Infectious Diseases Society of America (IDSA) have issued new guidelines to help prevent the spread of infections- mainly mrsa. Cleaning methodologies develop/implement protocols for cleaning and disinfecting area careful attention to high touch surfaces.

Hand washing- it is estimated 60% workers do not wash hands properly

What are bacteria and viruses?

Bacteria are single-celled organisms usually found all over the inside and outside of our bodies, except in the blood and spinal fluid. Many bacteria are not harmful. In fact, some are actually beneficial. However, disease-causing bacteria trigger illnesses, such as strep throat and some ear infections. Viruses are even smaller than bacteria. A virus cannot survive outside the body's cells. It causes illnesses by invading healthy cells and reproducing.

Bacteria can be divided into 2 groups:

Non spore forming- most bacterias. E-coli (salmonella), pseudomona, aeruginosa, klebsiella, staph, strep. 30-50% e-coli is beta-lactamase resistant. Gram Positive- MRSA, VRE, c-diff, e-coli- crystal violet test/respond better to antibiotics. Spore forming bacteria. Clostridium and bacillus families incl ESBL-3rd generation bacterias. There are approximately 5 nonillion (10×10^{30} th power) types of bacteria on earth. As we become a more global society, the more these organisms spread world-wide.

Types of bacterias and viruses:

Acingtobacter- found in soil/water. 80% accounts for reported infections in healthcare settings with seriously ill patients □ Burkholderia cepacia- found in soil/water. Complex bacterial- resistant to antibiotics, weakened immune system patients most affected. □ Clostridium Difficile- C-diff- I think this is going to be the “new MRSA”
o Causes inflammation of colon/colitis
o Can be deadly
o Risk factors- antibiotic use, nursing home environment, proton pump inhibitors (gerd medication), weakened immune systems
o Very rapidly spreads in nursing homes
o 500,000 + get a year in the us
o C-diff bacteria is in our environment-air, water, soil, meat, etc not dangerous to everyone
o Hard to treat_ ISO Certification for Silver Knight kills 77% organism in 8 hours
o Vancomycin may cost \$100K to eradicate infection
o Once you have had, you can get again easier
o Need to take probiotic with antibiotic because of change in flora in gi tract □ Clostridium Sordelli
o Rare bacteria that causes pneumonia, endocarditis, arthritis, peritonitis, myonecrosis, sepsis, toxic shock syndrome □ Enterobacteriaceae (Carbapenem resistance)
o Difficult to treat- high levels of antibiotic resistance
o Ex: Klebsiella species Escherichia Coli (e. coli)
o Part of gut bacteria
o In healthcare settings you can get CRS infections from ventilators, catheters, iv's or long term antibiotic use

Hepatitis- inflammation of liver, viral/A, B or C strains. Can be infected by needles, blood transfusions, hemodialysis, □ Human Immunodeficiency Virus (HIV/AIDS) o HIV virus destroys CD4 + and T cells resulting in weakened immune systems □ Influenza- typically a community based infection o 5-20% us population will see medical attention each year for flu; 200,000 will be hospitalized □ Klebsiella- o Gram-negative bacteria causing health care associated infections –including pneumonias, surgical site infections, meningitis o Resistant to Carbapenems antibiotics o Healthy people normal do not get- risk factors ventilators, iv's, long antibiotic course □ Methicillin-resistant Staphylococcus aureus- MRSA may be called staph o Typically infections of skin/soft tissues and sometimes lungs o More than half of the deaths of HAI are due to MRSA o MRSA is a subgroup of SA (Staphylococcus Aureus) o MRSA has adapted to beta-lactams ie penicillin, can be treated with methicillin if need vancomycin can be used but can cost up to \$100,000 o MRSA is on the rise in the US is estimated 95 m carry it in their nose/2b worldwide o MRSA means 3x hospital stay, 3x more cost, 5x risk of in-hospital death, 34% of patients affected with MRSA die within 30 days o MRSA is responsible for more deaths than AIDS (approx 2m each year) o Typically a nasal or respiratory infection o Healthy people can carry MRSA for several years while being asymptomatic o 75% of infections are localized to skin/soft tissue and can be treated o If not treated can affect vital organs and may become untreatable

Norovirus o Causes gastroenteritis – infection of lining of stomach/intestines causing severe diarrhea/vomiting (Cruise ships have had recently, also common with small children) □ Pseudomonas Aeruginosa- most strains of bacteria found in environment most common type to cause infection for weakened immune systems □ Staphylococcus aureus o Found in skin and nose in 30% of patients- most often do not cause harm, look like pimples □ Tuberculosis (TB) o Not usually antibiotic resistant o Must be in close contact o Vaccines can prevent □ Vancomycin intermediate staphylococcus aureus (VISA) and vancomycin resistant staphylococcus aureus (VRSA) o Most people who get this type of staph infection have underlying health condition such as diabetes or kidney disease □ Vancomycin-resistant Enterococci (VRE) o Resistant to vancomycin o Usually occurring in hospitals o Found naturally in intestines and female gi tract o Also found in improperly breed chicken o Can live on a wet surface for 1 week (sinks) up to 10 weeks on a dry surface (railing)

What kinds of infections are caused by viruses and should not be treated with antibiotics?
□ Viral infections that should not be treated with antibiotics include: □ Colds □ Flu □ Most coughs and bronchitis □ Sore throats (except for those resulting from strep throat) □ Some ear infections

What is an antibiotic?

Antibiotics, also known as antimicrobial drugs, are drugs that fight infections caused by bacteria. Alexander Fleming discovered the first antibiotic, penicillin, in 1928. After the first use of antibiotics in the 1940s, they transformed medical care and dramatically reduced illness and death from infectious diseases. □ The term "antibiotic" originally referred to a natural compound produced by a fungus or another microorganism that kills bacteria which cause disease in humans or animals. Some antibiotics may be synthetic compounds (not produced by microorganisms) that can also kill or inhibit the growth of microbes. Technically, the term "antimicrobial agent" refers to both natural and synthetic compounds; however, many people use the word "antibiotic" to refer to both. Although antibiotics have many beneficial effects, their use has contributed to the problem of antibiotic resistance. Antibiotic resistance is the ability of bacteria or other microbes to resist the effects of an antibiotic. Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. The bacteria survive and continue to multiply causing more harm.

Antibiotic resistant infections are on the rise

2011- CDC reported antibiotic infections cost the US an additional \$20B in healthcare costs, \$35M in other costs and 8m additional days in the hospital. Every day 1/20 patients get an infection from medical care/5% will die as a result □ Antibiotic resistance has been called one of the world's most pressing public health problems. Almost every type of bacteria has become stronger and less responsive to antibiotic treatment when it is really needed. These antibiotic-resistant bacteria can quickly spread to family members, schoolmates, and coworkers - threatening the community with a new strain of infectious disease that is more difficult to cure and more expensive to treat. For this reason, antibiotic resistance is among CDC's top concerns. □ The Detect and Protect Against Antibiotic Resistance Initiative (AR Initiative) goal for 2015 is to

- o Detect/track patterns
- o Respond to AR bacteria
- o Prevent spreading
- o Discovering new antibiotics treatments

□ Antibiotic resistance can cause significant danger and suffering for children and adults who have common infections, once easily treatable with antibiotics. Microbes can develop resistance to specific medicines. A common misconception is that a person's body becomes resistant to specific drugs. However, it is microbes, not people that become resistant to the drugs. □ Patients w/Antimicrobial resistant organisms have longer stays and more complications/treatment □ 5-10% of all hospital patients get an infection, 90,000 die (CDC) □ 1928 Fleming discovered penicillin- eerily he predicted there would be a time where bacteria would

What causes antibiotic resistance?

Natural Cause □ Selective Pressure- survival of the organism Antibiotics kill or inhibit the growth of susceptible bacteria. Sometimes one of the bacteria survives because it has the ability to neutralize or escape the effect of the antibiotic; that one bacterium can then multiply and replace all the bacteria that were killed off. Exposure to antibiotics therefore provides selective pressure, which makes the surviving bacteria more likely to be resistant. In addition, bacteria that were at one time susceptible to an antibiotic can acquire resistance through mutation of their genetic material or by acquiring pieces of DNA that code for the resistance properties from other bacteria. The DNA that codes for resistance can be grouped in a single easily transferable package. This means that bacteria can become resistant to many antimicrobial agents because of the transfer of one piece of DNA □ Mutation-microbes dividing/reproducing to evolve and adapt to new conditions □ Gene transfers between microbes □ Societal pressures-use of antimicrobials creates organisms to adapt □ Inappropriate use- over prescribing antibiotics □ Inadequate diagnostics- virus vs. infection do need antibiotic □ Taking broad spectrum instead of selective antimicrobial □ Hospital Use over prescribing to critically ill patients □ Agricultural use- antibiotics in meat/milk (eat organic or kosher) □ Over prescribing antibiotics or taking broad spectrum antibiotics, not finishing dose □ Using antibiotic soap triclosan chemical is a problem in 75% of antibacterial soap and bodywashes there is \$450M of antibacterial soap sold in the US yearly triclosan also in toothpaste/mouthwash Studies show may increase antibiotic resistance/affect immune system □ Chemicals in plastics such as water bottles (estrogenic chemicals/use bpa free plastics)