Infection Control Handbook for Schools
Edition 2

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Goal and Purpose of the Infection Control Handbook for Schools

This Handbook is designed to provide information that will enable schools to develop and implement effective infection-control practices while minimizing the use of, and exposure to, toxic products. The material is intended to be used by school personnel, including facility managers, head custodians, administrators, nurses, and purchasing agents, when customizing their school program.

The Handbook has been developed over several years by the National Cleaning for Healthier Schools and Infection Control Workgroup, which consists of representatives from the academic, public health, environmental health, medical, and school advocacy communities. The Handbook was updated to include information for the COVID-19 pandemic.

The Workgroup has found that a thorough, ongoing cleaning program is the best strategy to prevent disease transmission, with sanitization and disinfection activities playing only a part of the strategy in very specific situations. Following good cleaning procedures on a daily basis is considered a best practice and will reduce the need for disinfectants as well as the transmission of many diseases.

The purpose of this Handbook is to:

1. Educate the purchasers and users of disinfectants about (a) the health and environmental implications associated with using and misusing these products, (b) when disinfection is necessary, (c) proper disinfecting techniques, (d) the choices of disinfectants, (e) the criteria for selecting safer disinfectants, and (f) proper procedures for protecting the health of product users and building occupants.

2. Provide the tools needed for schools to create their own policies and protocols.

3. Provide information on the differences between cleaning, sanitizing, and disinfecting and when it is appropriate to use each methodology.

Limits of the Handbook

The Handbook provides basic information about the transmission of disease from pathogenic bacteria, fungi, and viruses, as well as related infection-control strategies (of which disinfection is one tool) to frame the discussion of disinfection. Because it does not address specific diseases found in school settings, the Handbook is designed to enhance a school’s infection-control program, not replace it.

Diseases and other health conditions that are not controlled through cleaning and disinfection practices in schools—such as sexually transmitted diseases, parasites (worms, scabies, lice), mosquito-borne illness, bites, and so forth—are not addressed in this Handbook. Although the response of many people to an outbreak of parasites is to disinfect, disinfecting is not an appropriate control strategy.

Introduction to the Issue

Protecting public health in a school building is a complicated issue. The time allowed for general cleaning tasks is constantly being reduced because of budget constraints and other competing
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Chapter 1: Introduction to the Handbook

needs. At the same time, there is a growing belief on the part of parents and school staff that all germs (referred to herein as “microbes”) need to be killed because of infectious-disease outbreaks in schools and other public places. This belief and the lack of time for routine cleaning and hand hygiene leads to the indiscriminate use of sanitizers, disinfectants, and antimicrobial hand products that may pose a hazard to staff, students, and the environment.

The Environmental Protection Agency (EPA), the federal agency that regulates and registers disinfectants and sanitizers, reports that over a billion dollars a year are spent on disinfectants and antimicrobial products. This figure illustrates the enormity of the industry and of product usage.

Disinfectants are not cleaners but antimicrobial pesticides designed to kill or inactivate microbes. Thus, they are not products that should be used indiscriminately. The overuse and misuse of these products is a growing public health and environmental concern. Studies have found that the use of some disinfectant products is creating microbes that can mutate into forms that are resistant to particular disinfectants or that become superbugs. Incorrectly using a disinfectant—such as wiping or rinsing the solution off the surface before the recommended contact time, not using the recommended dilution ratio, or using a combination disinfectant/cleaner when there is more dirt on a surface than the disinfectant can handle—may enable the bacteria that survive to mutate into these superbugs.

Understanding the Issue

There is a common misunderstanding in the general public about the role that bacteria, fungi, and viruses play in human health. Many people do not understand that microbes have both beneficial uses and negative impacts. Product manufacturers sometimes design media messages about the proliferation of germs and their potential health affects so as to cause public alarm and increase the desire for antimicrobial products.

In addition, the indiscriminate and interchangeable use of the terms sanitization and disinfection in some regulatory mandates on the type of products required for specific tasks in health care and early care and education settings often adds to the confusion regarding the level of microbe control that is required. These terms represent different levels of microbe control on different surfaces, and the EPA uses these terms to specify which products can be registered for each use:

Sanitizing – reduces but does not necessarily eliminate all the bacteria on a treated surface. Sanitizers do not have claims for viruses or fungi. To be a registered sanitizer, the test results for a product must show a reduction of at least:

- 99.9% in the number of each type of bacteria tested on non-food-contact surfaces. Examples of non-food-contact sanitizers include carpet sanitizers, air sanitizers, laundry additives, and in-tank toilet bowl sanitizers.
- 99.999% in the number of each type of bacteria tested (within 30 seconds) on most food-contact surfaces. Food-contact sanitizers are used in sanitizing rinses for surfaces such as dishes and cooking utensils, and in eating and drinking establishments.

Disinfecting – destroys or irreversibly inactivates infectious or other undesirable microbes, but not necessarily the spores (reproductive bodies similar to plant seeds) of bacteria and fungi. The number of microbes killed during a disinfecting process will vary, depending on the specific chemical and how it is used.
As a result of these misconceptions, the overuse and inappropriate use of these products poses a daily health risk. School cleaning programs must control the risk of the spread of infectious disease while simultaneously protecting the health of the custodial staff and building occupants from the health effects of using disinfectants made of powerful and sometimes toxic or hazardous chemicals.

**Health Issues**

It is well documented that disinfectants are associated with both acute and chronic health problems. In a recent study of cleaning products and work-related asthma, Rosenman and colleagues found that 12% of confirmed cases of work-related asthma were associated with exposure to cleaning products. Of these cleaning-related cases, 80% (4 out of 5) were new-onset cases (i.e., the cleaning product exposures caused new asthma in people who had not had it before). Of all the cleaning-related asthma cases, 39% were from medical settings, but 13% were from schools. In all work settings, 22% of those who had work-related asthma associated with cleaning agents worked as cleaners.4

Another study found that cleaning-product ingredients reported in work-related asthma cases included irritants such as acids, ammonia, and bleach, and disinfectants such as formaldehyde, glutaraldehyde, and quaternary ammonium compounds (QACs).5 Emerging science links QACs with reproductive problems as well.6

**Environmental Issues That Become Health Issues**

Residues of disinfectants that are washed down our drains and into our sewage treatment plants and rivers are triggering the growth of drug-resistant microbes. When the sludge filtered from treated sewage is spread on farm fields, high levels of bacteria with antibiotic-resistant genes have been found in soil samples from these fields. The presence of such bacteria may be due to the fact that although QACs kill nearly all microbes when used correctly, when used incorrectly, they can create resistant bacteria at the surviving low levels found in sludge and water samples.7 The resistant bacteria can result in antibiotic-resistant diseases like methicillin-resistant Staphylococcus aureus (MRSA).

**Disinfection as Part of a Cleaning for Health Program**

This Handbook is designed to be used as part of a Cleaning for Healthier Schools Program that focuses on the thorough cleaning of surfaces, particularly “high-risk” or “high-touch” areas, and on the targeted use of disinfectants and sanitizers for an infection-control strategy:

- High-touch areas: surfaces touched frequently and by a variety of hands over the course of the day. High-touch areas include door handles, faucet handles, handrails, shared desks, push bars, drinking fountains, and so forth. Areas touched by only one person, such as a personal computer keyboard, do not pose the same risk.
- High-risk areas: locations where there is a higher risk for bloodborne incidents, skin contact (MRSA risk), or contact with feces and body fluids. Examples of high-risk areas include the nurse’s office, athletic areas, and childcare centers.
Infection Control: A Three-Pronged Strategy

This strategy provides three methods for integration by the user, based on the most effective and least hazardous methods to use for each situation.

1. **Personal Hygiene Strategies for Microbe Control.** Hand and respiratory hygiene and cough and sneeze etiquette are key personal hygiene strategies that help to reduce the spread of some types of infectious diseases. This infection-control method involves facilitating an education program on hand hygiene that teaches and requires frequent hand washing and proper cough and sneeze procedures. This effort also involves providing hand-washing facilities and adequate time for hand washing. See Appendix A.5 Understanding Hand Hygiene for specific information. Posters, free and easily available from the Centers for Disease Control and Prevention (CDC) web site (http://www.cdc.gov/flu/protect/stopgerms.htm), encourage these activities and can be mounted throughout the school as part of an infection-control program.

2. **Managing Airborne Transmission.** Specific microbes such as SARS-CoV-2 may require additional attention to the airborne transmission of the virus. The CDC states that “airborne transmission is infection spread through exposure to those virus-containing respiratory droplets comprised of smaller droplets and particles that can remain suspended in the air over long distances (usually greater than 6 feet) and time (typically hours).”

The following are accepted strategies in schools to help prevent airborne transmission:

a. Increase the rating of the Heating, Ventilating and Air Conditioning (HVAC) system filter to a MERV 13A or as close to that as your system will accept.

b. Increase HVAC air changes to 6-12 per hour.

c. Install air cleaners/purifiers with High Efficiency Particulate Air (HEPA) filters in classrooms.

d. Install fans in windows that draw out air.

e. Open windows and doors to allow for natural ventilation where conditions allow.

3. **Cleaning for Health and Targeted Disinfection.** Comprehensive cleaning programs that use less-toxic products and updated tools and technology can help control the spread of infectious disease. This infection-control method involves removing the majority of the microbes and the conditions they need to survive and thrive. Frequent cleaning of high-touch areas with a third-party-certified (e.g., Green Seal, UL ECOLOGO®, Safer Choice) all-purpose detergent and a microfiber cloth is considered by experts to be sufficient to reduce the number of germs or pathogenic microbes on most surfaces to an acceptable level for public health unless otherwise directed by the CDC.

Research from the CDC states that large numbers of microorganisms can be removed by “the physical action of scrubbing with detergents and surfactants and rinsing with water.” Using high-quality microfiber cloths and mops as part of a cleaning program enhances this process, because studies show that microfiber is superior at capturing microbes.
4. **Disinfecting and Sanitizing for Microbe Control.** This infection-control strategy involves a targeted disinfection and sanitizing program that is designed to address high-risk areas, meet regulatory requirements, and respond to special events, incidents or pandemics in which there is a specific biological hazard. Only trained staff using approved products should perform designated disinfecting and sanitizing tasks.

**Recommendations on How to Use the Handbook**

When developing a disinfection policy and related work practices, the Workgroup recommends that schools or school districts form or use an existing stakeholder group to explore and customize the materials in the Handbook. A school stakeholder group should include representation, at a minimum, from the administration and from the facilities, nursing, athletic, food service, and teaching staff. Based on the outcome of this collaboration, the school system will need to provide infection-control training, policies, protocols, and posters; a list of approved disinfectants; and a schedule for cleaning and disinfecting. The school should also designate trained staff for specific tasks.

**Common Challenges**

While providing technical assistance to schools regarding their cleaning programs, members of the Workgroup found a general lack of training in the use of disinfectants. There is also a tremendous amount of pressure from parents and others to use disinfectants because they think this will protect the students and staff from communicable diseases. Following a written protocol can reassure staff, students, and parents that the school is taking the steps necessary to control infectious diseases.

The following challenges may need to be addressed when developing the protocol:

- Confusion on the part of staff about the differences between cleaning, sanitizing, and disinfecting and when to use each type of process and product
- The lack of training for teachers and staff on the correct usage and storage of disinfectants
- The pros and cons of providing teaching staff with school-approved disinfectants
- The lack of information on the effectiveness of third-party-certified cleaners used with microfiber cloths and mops as an alternative to disinfecting

**References**


**Resources**

### Chapter 1.B. Handbook Definitions

**Terms**

**Accelerated hydrogen peroxide** — hydrogen peroxide in synergy with a blend of commonly used ingredients that accelerate the disinfectant activity.

**Acute** — health conditions characterized by sudden onset and of finite duration. In addition, they tend to severely restrict the subject’s usual daily activities. The sudden-onset health effects—such as rashes, breathing problems, or headaches—are felt or noticed almost immediately, often within minutes or hours after exposure to a product or environment.

**Antibiotic** — a medicine designed to kill or slow the growth of bacteria and some fungi. Antibiotics are commonly used to fight bacterial infections but cannot fight infections caused by viruses.

**Antibacterial** — a term used to describe substances that kill or slow the growth of bacteria when treating human and environmental surfaces, including those that aid in proper hygiene. Examples of antibacterial-containing commercial products include hand soaps, gels, and foams, and dishwashing detergents.

**Antimicrobial** — a general term used to describe substances (including medicines) that kill or slow the growth of microbes. Examples of antimicrobial agents include the following:

- Tetracycline (an antibiotic that treats urinary tract infections)
- Oseltamivir or Tamiflu® (an antiviral that treats the flu)
- Terbinafine or Lamisil® (an antifungal that treats athlete’s foot)

**Antimicrobial pesticide** — any chemical substance that can be used to kill microorganisms. These products are used to disinfect and sanitize, and to reduce the growth or development of microbiological organisms.

**Antiseptics and germicides** — substances used to prevent infection on living tissue by inhibiting the growth of microorganisms. Because these products are used in or on living humans or animals, they are considered drugs and therefore regulated by the Food and Drug Administration.

**Asthma** — a chronic inflammatory disease that results from a complex interplay between environmental and genetic factors. The disease causes inflammation, with recurrent episodes of wheezing, chest tightness, cough, shortness of breath, and/or difficulty breathing. After asthma develops, the airways of the lungs become more responsive to a variety of stimuli. If left untreated, the resulting inflammation may lead to irreversible changes in the structure of the lung.

**Asthmagens** — substances capable of causing new-onset asthma. The Association of Occupational and Environmental Clinics (AOEC) has established criteria for determining whether a substance is an asthmagen.
**Bacteria** – microorganisms that are found on our skin, in our digestive tract, in the air, and in the soil. Most are harmless (nonpathogenic). Many are helpful because they occupy ecological niches (both within our bodies and in the external environment) that could be occupied by harmful (pathogenic) bacteria. These helpful strains keep harmful microorganisms in check. They also help our digestive system to function effectively and stimulate the development of a healthy immune system. Beneficial bacteria are also used in the fermentation process that creates bread, wine, cheese, yogurt, and other foods and beverages.

**Bactericide** – a pesticide used to control or destroy bacteria, typically in the home, in schools, or on hospital equipment.

**Chronic** – health conditions in which the onset may not be noticed and characterized by a gradual progression of symptoms or by problems of a more permanent nature resulting from a series of acute conditions. Daily activities may or may not be restricted during any given period, although there is usually a more general series of activity limitations.

**Cleaning** – the removal of foreign material (e.g., soil and organic material) from surfaces and objects, normally accomplished with detergents or soaps. Cleaning is required prior to disinfection processes for them to be most effective.

**Corrosive** – a corrosive material is a highly reactive substance that causes obvious damage to living tissue. Corrosives act directly by chemically destroying the tissue (oxidation) or indirectly by causing inflammation. Acids and bases are common corrosive materials and are sometimes referred to as caustics. Typical examples of acidic corrosives are hydrochloric (muriatic) acid and sulfuric acid. Typical examples of basic corrosives are sodium hydroxide (lye) and ammonia.

**COVID-19** - an acute respiratory illness in humans caused by the coronavirus SARS-CoV-2, capable of producing severe symptoms and in some cases death, especially in older people and those with underlying health conditions.

**Detergent** – a substance that aids in the removal of dirt. Detergents act mainly on the oily films that trap dirt particles. Detergent molecules have a hydrocarbon portion that is soluble in oil and an ionic portion that is soluble in water. Bridging the water and oil phases, the detergent acts as an emulsifier, breaking the oil into tiny droplets and suspending them in water. The disruption of the oil film allows the dirt particles to be washed away.

**Disinfectant** – a chemical or physical agent used on hard inanimate surfaces and objects to destroy or irreversibly inactivate vegetative microorganisms, viruses, and infectious fungi and bacteria, but not necessarily their spores.

**Disinfection** – a process that is used to reduce the number of viable microorganisms on a surface but that may not necessarily inactivate all microbial agents (e.g., spores and prions).

**Efficacy** – a measure of the ability to achieve desired results. Disinfectants are registered for their ability to kill certain microbes, and efficacy in this case relates to the percentage of target microbe(s) that are killed or removed.
**Endocrine disruptor** – an external agent that interferes in some way with the role of natural hormones in the body. Such an agent might disrupt the endocrine system by affecting any of the various stages of hormone production and activity; for example, by preventing the synthesis of hormones, by directly binding to hormone receptors, or by interfering with the natural breakdown of hormones.

**Environmental Protection Agency Registration Number (EPA Reg. No.)** – a two-part number assigned by the EPA to identify the pesticide product registration (e.g., 1253-79) that must appear on a product’s label. The first number is the company number and the second number (after the dash) is the product number.

**Fecal coliform bacteria** – bacteria found in the intestinal tracts of mammals. When present in water or sludge, it is an indicator of pollution and possible contamination by pathogens.

**Fungus** – a plant that has no leaves, flowers, or roots. Examples of fungi (or funguses) are mushrooms, molds, mildews, and yeasts.

**Microbe** – a collective name for microscopic organisms including bacteria (e.g., *Staphylococcus aureus*), viruses (e.g., influenza A and B, which cause the flu and SARS-CoV-2), fungi (e.g., *Candida albicans*, which causes some yeast infections), and some parasites (e.g., *Toxoplasma* species, which cause toxoplasmosis).

**Microbial pesticides** – microorganisms that are used to kill or inhibit pests such as insects or other microorganisms. Sometimes these microbes are effective simply by increasing in number, using the pests’ food supply, and invading their environment.

**Microorganisms** – bacteria, yeasts, simple fungi, algae, protozoans, and a number of other organisms that are microscopic in size. Most are beneficial, but some produce disease. Others are involved in composting and sewage treatment.

**Pandemic** – Defined as “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people.”

**Pathogen** – any organism or infectious agent capable of causing disease or infection.

**Pesticide** – a substance intended to repel, kill, or control any species designated a “pest,” including weeds, insects, rodents, fungi, bacteria, or other organisms. The family of pesticides includes herbicides, insecticides, rodenticides, fungicides, and bactericides.

**Pesticide residue** – pesticides that may remain on or in the plant, food crop, soil, container, equipment, handler, and so forth, after application of the pesticide.

**Quaternary ammonium compounds (QACs or quats)** – a family of several hundred chemicals with a similar chemical structure (one positively charged nitrogen atom at the molecule’s center) that are known for their disinfectant or detergent properties. Quats are the active ingredients in many disinfectant products used in schools. They are effective against some bacteria, viruses, fungi, and algae. Product labels specify the microbes they target. One example of a QAC is benzalkonium chloride.
**Registrant** – a pesticide manufacturer that has registered a pesticide product.

**Registration** – a formal listing with the EPA of a new pesticide before its sale or distribution. The EPA is responsible for premarket licensing of pesticides on the basis of data that demonstrate that there are no adverse health or environmental effects when applied according to approved label directions.

**Respiratory sensitizer** – a substance that induces hypersensitivity of the airways following inhalation of the substance.

**SARS-CoV-2** - Severe acute respiratory syndrome coronavirus 2 is the strain of coronavirus that causes COVID-19, a respiratory illness responsible for the COVID-19 pandemic.

**Sanitizer** – a product used to reduce (but not necessarily eliminate) microorganisms (usually bacteria) in the inanimate environment to levels considered safe, as determined by public health codes or regulations. Sanitizers include food-contact and non-food-contact products.

**Sensitizer** – a substance that can produce an allergic reaction in the skin or respiratory tract in some individuals. Skin sensitization is called allergic dermatitis. Respiratory sensitization can include rhinitis (hay fever) and/or asthma. These reactions occur after re-exposure to the same substance after initial sensitization exposure has occurred.

**Sterilization** – a validated process used to render a surface or instrument free from all viable microorganisms.

**Viruses** – microorganisms that are smaller than bacteria and cannot grow or reproduce apart from a living cell. They invade living cells and use the cell’s chemical machinery to stay alive and to replicate themselves. Thus, to survive and reproduce, they must invade a host cell (animal, human, plant, or bacteria). Virus infections may be spread by way of the air, by contact with surfaces, and by the exchange of body fluids.

**Organizations**

**Centers for Disease Control and Prevention (CDC)** – an agency of the US Department of Health and Human Services. Its mission is to “protect America from health, safety and security threats, both foreign and in the U.S.” As its name says, this agency provides guidance on preventing and controlling disease.

**Food and Drug Administration (FDA)** – an organization involved in the regulation of pesticides in the United States, particularly with the enforcement of pesticide tolerances in food and feed products.

**Environmental Protection Agency (EPA)** – an agency that registers disinfectants and sanitizers in the United States, among other activities.

**World Health Organization (WHO)** – a specialized agency of the United Nations responsible for international public health.
Regulations

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) – a law enacted on June 25, 1947, that instructs the EPA to regulate (1) the registration of all pesticides used in the United States, (2) the licensing of pesticide applicators, (3) re-registration of all pesticide products, and (4) the storage, transportation, disposal, and recall of all pesticide products.

Sources


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