"Safe Hospital"

INE-SADI-ADECI Interinstitutional Consensus 2023

cih SOLUCIONES AMBIENTALES
AADAIH Asociación Argentina de Arquitectura e Ingeniería Hospitalaria
SADEBAC Sociedad Argentina de Bacteriología, Micología y Parasitología Clínica
ADECI ASOCIACIÓN ARGENTINA DE ENFERMEROS EN CONTROL DE INFECCIONES
sadi Sociedad Argentina de Infectología
Instituto Nacional Epidemiología "Dr. Juan H. Jara"
ANLIS MALBRÁN
Ministerio de Salud Argentina

Carrizo, Paula
Safe Hospital: INE-SADI-ADECI Interinstitutional Consensus 2023 / Paula Carrizo; Angel Colque Irene Pagano. - 1st ed. - Autonomous City of Buenos Aires: National Administration of Health Laboratories and Institutes -ANLIS Dr. C. Malbrán, 2023.
Digital book, PDF

Digital File: download available at: https://sgc.anlis.gob.ar/handle/123456789/2601 ISBN 978-987-48850-5-0

1. Security Measures. 2. Public Health. 3. Hospitals. I. Colque, Angel. II. Pagano, Irene. III. Qualification.
CDD 362,042

"This resource is the result of the financing granted by the National State, therefore, it is subject to compliance with Law No. 26,899 and the knowledge management policy of the ANLIS."

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Introduction - Hospital Safety

Advances in medicine and technology require a constant reevaluation of health institutions to provide a safe environment for patients, health personnel, visitors and family members. There are multiple variables to take into account, which is why this requires multidisciplinary teamwork.

The structures of our Health institutions in the Argentine Republic require a wide range of human, economic and technological material resources. These elements are brought together in integrated sets, where the structure supports the processes and these support the results. The aspects of functional or organizational vulnerability refer to the distribution and relationship between the architectural spaces of the medical services. In this document it is important to have the necessary recommendations for any modification of the structure, prioritizing the safety of the patient and the health workers. Health institutions.

Scientific evidence has shown that adequate ventilation is essential in reducing the transmission of viruses, bacteria and fungi through circulating air, also by the aerosol produced by expectorations, inhalation and expulsion of air from one person to another, and by the entry of external agents, particles and contaminated gases, among others. This requires proper design, operation and maintenance to ensure economical and safe management of the system. The SARS-CoV-2 pandemic highlighted the heterogeneity of ventilation in health institutions and the challenge of being able to provide safe environments for patient care.

To provide care with safe water, it is essential to work on the prevention of reservoirs of microorganisms that are characterized by survival or proliferation in humid spaces. A multidisciplinary team must be formed to work on the design, development and management of a safe water plan. Among its main responsibilities are the definition of activities and the implementation of an action plan with defined roles.

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VENTILATION

Introduction :

Adequate ventilation aims to provide interior spaces that promote the well-being of patients, workers and visitors, thus contributing to the prevention of conditions related to poor air quality, including airborne infections. Adequate ventilation in a health institution reduces the risk of contaminating agents and pathogens existing at levels that can cause health conditions. Among the risky contaminants are microorganisms, particulate matter (dust), toxic or narcotic gases, disinfectants, odoriferous substances and others normally present in clinical environments. Adequate ventilation also protects immunocompromised and immunosuppressed patients, the community and health personnel who carry out their tasks.

It is, therefore, a matter of public health to ensure that the building has good air quality in these indoor environments, achieved through adequate ventilation.

Air conditioning is essential to achieve good ventilation, which is made up of the following steps:

A.- Thermal comfort

Thermal comfort is a mental state of satisfaction that is achieved with adequate architectural design and the use of ventilation and air conditioning systems. Without a correct design, the challenges of achieving adequate thermal comfort are accentuated. For example, a skylight without solar control that directly impacts a waiting room at midday will surely be difficult to retrofit. Thermal satisfaction is not absolute since in the best of cases 95% acceptance by people is achieved. Beyond thermal radiation, a product of being close to a noticeably cold or hot object, such as a window, in general these three objectives must be met to obtain thermal satisfaction:

- Supply and maintain interior spaces with heated or cooled air according to the seasons of the year or the needs of the interior spaces.
- Supply and maintain adequate relative humidity, which is obtained by reducing excessive relative humidity or incorporating humidity into the environment.
- Adapt air movement without causing gusts that contribute to an effective heat exchange between the person and the indoor air.

B.- Indoor air quality

Adequate air quality requires as a starting point having air free of contaminants and that is also not the product of objections due to unpleasant odors or that may affect the majority of people.

Ventilation plays a critical role in the extraction of contaminants from indoor environments, such as extraction hoods, suction equipment with discharge to the outside or in-situ filtering. In addition, ventilation performs the important function of diluting contaminants present in the indoor air. This dilution is only achieved by incorporating outside air, which must be properly treated through adequate filtration. In certain cases, indoor air can be used from a room with adequate air quality that meets the corresponding requirements.

From the principles of environmental hygiene, it is clear that there are hierarchies of order in terms of what to do to obtain adequate air quality. The first measure to consider is always the elimination of the polluting agent, such as eliminating the use of irritating fragrances. that mask odors. If eliminating a source of pollutant generation is not feasible, this agent should be replaced with one that affects air quality to a lesser degree, for example, replacing formaldehyde with glutaraldehyde whose toxicity is less. If these methods of contaminant control are not feasible, extraction ventilation is incorporated, eliminating the contaminant at its source and preventing it from spreading to the indoor air. It should be noted that there are a number of precedents that, due to regulations or good practices, must be carried out using extraction, such as the case of tasks carried out in laboratory hoods.

It follows from the above that, although ventilation is fundamental and necessary to promote a healthy space, the elimination or reduction of contaminants that are emitted into the air must be of extreme consideration. Safety and hygiene personnel from medical institutions are generally able to provide support in these concepts.

The adequate relationship of internal pressures between rooms and with the outside is also critical to direct the air in the direction it should circulate. This is known as a pressure cascade, in which air migrates from one space to another according to a contaminant control plan, and can be positive or negative pressure as appropriate. For example, a pathology laboratory must be ventilated in such a way that it is under negative pressure with respect to a hallway, thus preventing the migration of xylene vapors. The interiors of the building must be positive with respect to the outside air, thereby avoiding introducing exogenous contaminants such as particulate matter (dust) from the outside.

Finally, adequate air quality is achieved by distributing properly filtered and treated air within the building, and its flow rates and air changes must be verified according to the use, size and occupancy of the interior spaces. Consequently, adequate ventilation is one that was designed, built, installed, operated and maintained correctly to achieve the desired air quality for each room.

In this chapter we will discuss the different strategies to obtain adequate indoor air quality.

Goals:

- Define the characteristics of adequate air quality and ventilation for health institutions.
- Provide tools for evaluation and training on air quality and ventilation in hospital areas.
- Define criteria and forms of verification control and audits including ventilation systems and their maintenance from the perspective of Safe Hospital.
- Highlight the importance of control hierarchies to achieve adequate indoor air quality.
- Provide graphic examples of tasks related to audits.

Key concepts:

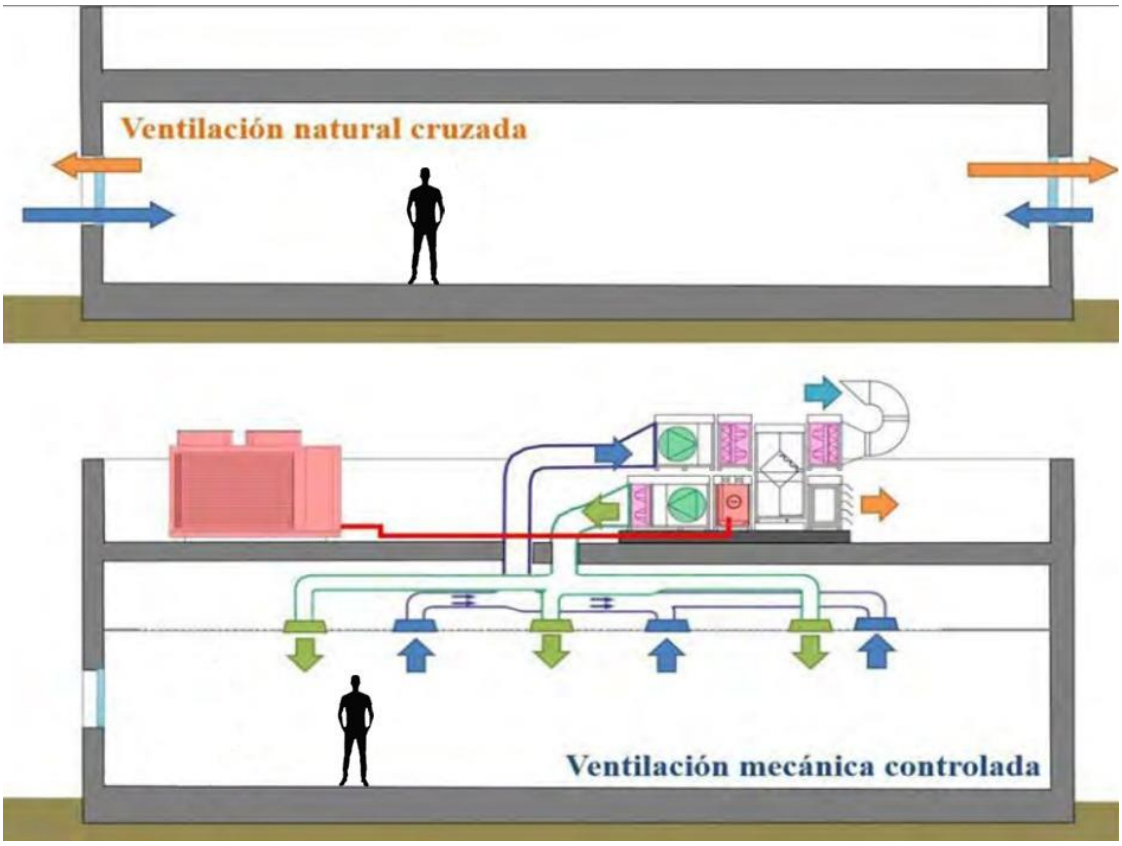
Ventilation:process by which air is incorporated or removed from an enclosure for the purpose of controlling contaminant levels, temperature or relative humidity. In general, pollutant control is achieved by incorporating outside air into indoor environments.

Natural ventilation: is the use of natural forces to introduce and distribute outside air, or to extract air. These natural forces can be wind pressure or pressure generated by the difference in density between indoor and outdoor air. To be effective, it is recommended that it be CCD, that is, continuous over time, crossed (opening of windows and doors on different faces) and distributed over its surface. It should be considered that, if natural ventilation is used, the entry of air with external pollution, both particulate matter and gases, must be controlled.

Controlled mechanical ventilation - VMC:In their simplest form they are those provided by mechanical fans. They can be installed directly on windows or in air ducts to supply outside air to a room or extract stale air from it. In general, an institution must have mechanical ventilation systems that have thermal conditioning and contamination control systems for particulate matter through filtration. Likewise, have distribution duct systems to control internal and external pressures.

As with natural ventilation, it is recommended that it be continuous, with an adequate distribution of the supply and extraction elements, and that it does not have areas where air accumulates and "stagnates", preventing its renewal.

Mixed or hybrid ventilation: is cWhen the flow rates of natural ventilation are combined with mechanical ventilation, installing fans or extractors to achieve the required ventilation rates, in which the extraction is carried out mechanically and the admission is produced through the uncontrolled entry of air into the enclosure. through openings due to the depression generated; or the symmetrical variant of this ventilation model, in which the supply is carried out mechanically, which generates overpressure in the room, trusting that the air will be extracted through the openings.



HEPA: They stand for High Efficiency Particulate Air or Arrestor, and are considered high efficiency filters, also called in certain cases terminal filters. The theoretical efficiency of a HEPA filter is at least 99.97% for particles equal to or greater than 0.3 microns in diameter.

Types of Airborne Pathogen Transmission :

TO.**Air Respiratory Transmission:**transmission of pathogens that are carried by respiratory droplets, smaller than 100 µm, that remain suspended in the environmental air for a long time, for example:*Mycobacterium tuberculosis*, measles virus, varicella zoster virus, SARS-CoV-2.

b.**Respiratory Droplet Transmission**: transmission of pathogens that are carried by droplets larger than 100 µm over a short distance (less than one meter), for example: Influenza virus,*Streptococcus pneumoniae*,*Neisseria meningitidis*, etc.

Assessment of indoor air quality and ventilation:

Many indoor air quality deficiencies are estimated to be due to a variety of issues. If there are spaces that have been properly designed and built for their current use, the emphasis of environmental evaluations must consider

certain essential aspects that combine (1) visual inspections and (2) measurements of the ventilation system:

(1) Visual inspections: The purpose of visual inspections is to identify tasks or situations that negatively compromise air quality, for example, carrying out building renovations such as sanding walls without the corresponding control procedures, allowing the use of flowers in rooms with patients, shaking out a carpet inside the building or seal a grate with cardboard. In this way, the aim is to identify procedures that affect air quality.

Likewise, within the visual inspections, the aim is to validate the operating conditions of the ventilation systems, thus verifying, jointly with operation and maintenance personnel, the proper function of the equipment and systems. For example, coordinating visits to the machine rooms, verifying the status of filtration, prophylaxis of air systems and operation of extractors and injectors. If duct ventilation systems are available, ocular inspections assisted with borescopes may also be included to identify the prophylaxis of the ventilation ducts.

Among the visual inspections is the observation of the verification of air pressures that can be observed through pressure gauges that are strategically located at access to premises of use.

(2) Environmental determinations and measurements of ventilation systems: Among the elements to be considered in environmental determinations is the execution independently or jointly with safety and hygiene personnel and maintenance of indoor air quality measurements that allow validating adequate indoor air quality, air flows and renewals. prescribed for each functional space. Sampling may include microorganisms of interest (fungal, bacterial, etc.), gases, particulate matter of 2.5 and 10 microns, and thermal comfort elements such as relative humidity, ambient temperature, speed of air gusts, in addition to verifying air flows and pressure cascades.

The methods commonly used to evaluate microorganisms are those that use a specific or general culture medium. The selection of the culture medium should be based on the sampling objective.

- **Static:**It is a qualitative procedure based on passive sedimentation (impaction). It is based on leaving culture plates open for a certain time, collecting by the deposition of suspended microorganisms present in the air. This method presents great challenges since it is subject to wind variations and air currents, so under no circumstances should it be used to quantitatively determine the concentration of microorganisms in the air. That is, its use should be limited to a qualitative evaluation of viable sedimentable particulate material of microbiological origin.

- **Viable volumetrics**: It is the method of first choice, where the Andersen N6 type sampling device passes a determined volume of air through a calibrated perforated grid, impacting a culture medium.
- **Total volumetric**(viable and non-viable due to impact): These are state-of-the-art sampling and analysis methods that are based on traps with disposable venturi cones. These methods allow rapid sampling and analysis of spores and particulate matter, identifying the morphology of viable and non-viable spores.
  It is the most used method in various countries for an expeditious counting of fungi, especially when seeking to find the agent causing environmental contamination.

With respect to cultures, in both cases the samples are incubated at a defined temperature and for a certain time, depending on the microorganisms being searched.

Cutoff points for microorganism studies:

Cutoff points are prescribed levels of air quality acceptance from a microbiological perspective. Quantitative and qualitative aspects are taken into consideration.

- **Quantitative study:**The number of colonies is expressed by this procedure, expressed in colony forming units (CFU) per $m^3$of air.
- **Qualitative study**: The flora present in the crop is identified by this procedure. Depending on the microorganisms detected, the source of contamination, both endogenous and exogenous, can be inferred. For example, if you find *Cladosporium*sp. It can be inferred that it is a source of outdoor air pollution due to infiltration, while if species such as *Stachybotrys chartarum*It is likely due to fungal contamination in drywall that has been recently disturbed. If found *Aspergillus*sp. It is likely due to disturbance of cellulosic-based materials that have been exposed to water. Certain species of filamentous fungi are opportunistic, so if they are found in the air it is essential to identify their source. Among them are:*Aspergillus* sp.,*Mucor*sp.,*Rhizopus* sp.,*Scedosporium*sp.,*Penicillium*sp.,*Candida*sp. and other yeasts. Regarding bacteria, it is important to identify the type, since if it is*Pseudomonas*sp. they are likely to be associated with aerosolization of decaying water, or in the case of Legionella where the source may be aerosolization of hot water or cooling towers. In all cases the selection of the culture medium and incubation temperature is crucial. (Annex I)

- **Recommended values:**In the case of critical rooms such as operating rooms, the culture of filamentous fungi should not exceed 0.1 CFU/m as an admissible value.3, taking into account that at least 1000 liters of air must be taken to obtain an adequate detection limit. On the other hand, patient treatment sectors should not exceed 15 CFU/m3of air.

  Meanwhile, for aerobic counts, the admissible values depend on the type of operating room, their values being considered as:

  - Very clean environment <10 CFU/m3
  - Clean environment <10-100 CFU/m3
  - Acceptable environment 100-200 CFU/m3

In class A operating rooms, a very clean environment must be guaranteed, that is, with an aerobic level below 10 CFU/m3.

Ventilation Evaluation:

The level of ventilation required by an enclosure can be expressed with different indicators, all of them related to each other. This allows controlling, by dilution, the level of the parameters and contaminants described above.
These ventilation level indicators can be indirect (it is assumed that with a certain amount of air the required dilution can be achieved), or direct (it allows the amount of outside air to be regulated according to the evolution of the room). Among the most used indirect indicators are the following:

- **Airflow**. It is common that, for greater convenience, it is indicated that the renewal air flow rate is established per occupant, per unit of surface area (m^2) or both. It is usually expressed in our country in cubic meters per hour (m^3/h) or in liters per second (l/s). One m^3/h corresponds to 0.278 liters/sec. Air speed is usually measured with hot-wire or propeller anemometers. The flow rate is the relationship between the speed of the air and the surface through which the air circulates. In the case of a duct, the flow rate is the product of the air velocity measured at different points on the plane, multiplied by the area of the duct at the measurement point. The instruments must be properly calibrated and the air temperature must be measured at the same time to make the corresponding flow corrections.
- **Renewals per hour**(CAH, air changes per hour). With 1 CAH, an air flow equivalent to the volume of the room is introduced in one hour and is expressed in CAH/h. For example: if a room has 1 CAH (1 air renewal per hour) it means that in one hour a volume of outside air equal to the volume of the room enters the room and the same volume moves out of the room. The degree of replacement will depend, among other things, on mixture (bleed) coefficients related to how close the installation is to a hypothetical total displacement piston effect. how much

The more stratification or short circuit of the injected air versus the return or expulsion, the less the actual air changes will be at all points of the room. For example, in the corners or vertices of the rooms, less air exchange tends to be detected. To calculate air changes, the injected and expelled air must be measured, as well as the dimensions of the room. The differences between the injected air and the expelled air are considered exfiltration or infiltration, depending on the value obtained. It is important to take this last point into account, since an infiltration in

A critical sector of the hospital can mean cross contamination due to failures in pressure cascades or leaks in the envelope (walls, ceilings and floor) of the enclosure.

- **Types of Filters.**Filters traditionally used in hospitals are to retain particles and aerosols of various sizes. The higher the prophylaxis level for an enclosure, the higher the filtering efficiency should be. Filters with the capacity to retain gases are rarely incorporated into hospitals and health centers, unless they are absorbers in equipment, such as those for anesthetic gases. The efficiency or arrestance in the particle filtration process is determined by the percentage of particles that, after passing through the filter, are retained in the filter material. There are different standards to determine the degree of particle filtering, including the ASHRAE 52.2 standard (American Society of Heating, Refrigerating, and Air Conditioning Engineers) and the UNE-EN 1822 standard (Spanish Association for Standardization, Absolute Filters). . The classification of filters according to UNE-EN 1822 is detailed below.

Classification of the high filters efficiency	Kind of filter	Efficiency in retention	Penetration	Number of particles left pass through every 100,000 suspended particles in the air
Filter of high efficiency EPA	E 10	≥ 85%	≤ 15%	15,000
	E 11	≥95%	≤ 5%	5,000
	E 12	≥ 99.55%	≤ 0.5%	500
Very high efficiency filter HEPA	H 13	≥ 99.95%	≤ 0.05%	fifty
	H 14	≥ 99.995%	≤ 0.005%	5
Particle filter ultrasmall in air ULPA	U 15	≥ 99.9995%	≤ 0.0005%	0.5
	U 16	≥ 99.99995%	≤ 0.00005%	0.05
	U 17	≥ 99.999995%	≤ 0.000005%	0.005

In addition, there is the UNE-EN 779 standard - Air filters used in general ventilation to eliminate particles, which has equivalences with ASHRAE 52.2. The following table details the equivalences between both standards:

Average arrest	ASHRAE 52.2	EN 779
80% < A < 90%	MERV 5/6	G3
90% <A	MERV 7/8	G4
Average Efficiency	**ASHRAE 52.2**	**EN 779**
40% < E < 60%	MERV 9/10	M5
60% < E < 80%	MERV 11/12	M6
80% < E < 90%	MERV 13	F7
90% < E < 95%	MERV 14	F8
95% <E	MERV 15/16	F9
MPPS efficiency	**ASHRAE 52.2**	**IN 1822**
≥ 99.5%	MERV 17	H12
≥ 99.95%	MERV 18	H13
≥ 99.995%	MERV 19	H14
≥ 99.9995%	MERV 20	U15
≥ 99.99995%		U16
≥ 99.999995%		U17

General recommendations for verification of periodic control of ventilation systems will depend on the area:

The recommendations presented below respond to the minimum criteria to follow in order to verify ventilation system conditions that promote good indoor air quality in hospitals. Its execution focuses on a visual and olfactory inspection of the systems where it is important to photographically document the observed conditions. The purpose of the olfactory evaluation is to identify undesirable, fungal or chemical odors that may compromise the establishment's air quality. The criteria are:

- Prior to the start-up of ventilation equipment or after repairing major breakdowns. This verification is carried out because when the equipment is not in operation for a long time or is part of a new installation without proper environmental protection, it can accumulate particulate material (dust) or other contaminants on its interior surfaces.
- After a major renovation. In the same way as the previous point, large renovations that have not taken into account a rigorous construction pollution control plan usually cause cross contamination with construction and finishing materials, impacting the interior surfaces of the ventilation systems.
- After cleaning also called mechanical hygiene of the air conditioning ventilation system. Mechanical hygiene involves a significant disturbance of the interior surfaces of the systems; if the ventilation systems have not been properly cleaned and purged, a discharge of contaminants, especially particulate matter, to the areas subject to ventilation is usually experienced, causing widespread contamination.
- Given the appearance of cases of nosocomial infection with a possible epidemiological relationship, ventilation systems, particularly those that in turn air conditioning by cooling the air, tend to accumulate microorganisms and pathogens that can cause infectious outbreaks.
- Periodic control carried out by building operation and maintenance personnel, and verification by the infection control committee.

Recommendations for ventilation criteria according to area:

There are fundamental aspects regarding minimum ventilation criteria, among them the following stand out:

- Conditions of fenestration points, especially windows with direct contact to sectors with lower indoor air quality requirements.
- Airflow.
- Filtering level of particulate matter.

In order to minimize the “short circuit effect” that occurs when contaminated air is expelled to the outside and outside air is incorporated at a point close to the discharge point, it must be

Maintain a distance of no less than 8 meters between the discharge point and the injection point. These systems are usually found on the terraces of buildings, although they can also be found on the sides, facades or at street level. In general terms, all central ventilation equipment must have maintenance certified by the providing companies and verified by maintenance and infection control personnel of the institution. (Annex II)

The areas of health institutions, taking into account the characteristics of the patients or the activities carried out in them, can be divided into the following categories. (Annex III)

1- Critical care units

1.1- Rooms/Intensive Care Unit (ICU), including burn unit

The rooms of the intensive care unit or burn unit must have fixed and sealed windows, so ventilation through a fenestration point is not allowed. The ventilation and thermal conditioning systems must have a minimum filtration of at least 90%, with low efficiency filters (G4) added to a medium efficiency filter (F8).

1.2- Isolation rooms

From the perspective of air pollution prevention, it is desirable to have physical means of separation between the hallways and the isolation room, so if feasible, the incorporation of an antechamber is recommended, which can serve as a decontamination lock. These isolations have two variants, one is for infectious patients and the other for immunosuppressed patients, or rooms that in their construction can receive patients with one pathology or another, having previously carried out the corresponding sanitation and set-up protocols. With infectious patients, the antechambers have negative pressure with respect to the common areas and positive pressure with respect to the isolation room. In patients with conditions that require protection from pathogens or external intramural contamination, the room pressure must be positive with respect to the antechamber and positive with respect to the outside. Patients who meet both conditions must have rooms positive with respect to the antechamber and the antechamber, in turn, negative with respect to the common areas. In this case, the air from the antechamber is expelled to the outside in order to maintain the pressure inside the room.

For patients with infectious diseases: Patients with infectious diseases who protect themselves through the air require specific air quality conditions, so ventilation is critical to minimize exposure to the patient's pathogens. This is why infection control measures must be implemented.

for people with confirmed or suspected airborne infections.

In these rooms you must take into account:

- Natural ventilation with air flow of at least 45 m^3/h per patient, with at least 12 total air changes per hour, of which two of the changes must correspond to outside air.
- The differential pressure must be negative with respect to common or adjacent areas. The air in a room must be expelled to the outside, after passing through a filter cabin with high efficiency HEPA filters (H13). Being a less desirable alternative option is the incorporation of individual purification equipment with HEPA filters.
- If there are no HEPA filters for discharge to the outside, the air must be expelled outside, away from the air intake ducts, clinical areas and people, with a distance of at least 8 meters from outside air intakes. windows or other fenestration point.
- If all air is exhausted to the outside, there must be a return grille at floor level behind the patient's bed. A filtering cabin with high efficiency filters is inserted into this extraction.
- When mechanical ventilation is used, the direction of air flow must be controlled.
- Room air should not be recirculated to other areas.
- The minimum filtration in the air injection must be greater than 90%: Low efficiency filters (G4) + Medium efficiency filter (F8) + UVC (air unit coil lamps).

- The relative humidity must be maintained between 40 and 60% and the temperature between 21 and 24°C.
- Personnel entering the room must wear an N95 mask, and the room door must be kept closed.

For patients with immunosuppression: They are high-risk patients, so the objective is to protect the patient from microorganisms that may be inhaled, caused by the personnel who care for them, by other hospitalized patients, or by ventilation or infiltration of air from the perimeter environment to the room. For this reason, patients with immunosuppression must be housed in Protected Environment (PA) rooms, and air quality must be considered through:

- A direct injection of air into the room, which must be filtered with a HEPA filter (H13).
- The air inside the room must maintain 12 air changes per hour and the pressure in the room must be positive with respect to adjacent areas (differential pressure: 2.5 pascals).

- Extraction of all air to the outside of the room with a return grille at floor level behind the patient's bed. A filtering cabin with high efficiency filters is inserted into this extraction.
- Recirculation with other areas is not recommended.
- The relative humidity must be maintained between 40 and 60% and the temperature between 21 and 24°C.
- Ceiling or standing fans are not recommended due to the negative effect on air direction and flow.
- Windows, walls, ceilings, floors, electrical outlets, etc., must be hermetically sealed to prevent the entry of outside air. To the extent possible, the doors of the AP rooms should have an automatic “door-close” system, to help maintain the correct pressure differential.
- The air flow must be positive, in relation to the corridor (air flows from the room to the adjacent outdoor space). Direct room airflow to enter from the side and move across the patient's bed. The air should exit through a duct located on the opposite side of the room.

- Use an anteroom so that an adequate balance can be achieved between the air in corridors and corridors and that of the AP. If the air must be recirculated, a separate duct must be provided to exhaust contaminated air outside the room or a HEPA filter must be placed at the exit of the duct.

Microbiological control for protected environment rooms: Air measurement is carried out to identify fungi and other environmental contaminants of microbiological origin by air suction with a volumetric meter or, failing that, by direct impaction on culture media or the spore trap type.

Controls must be carried out prior to the authorization of a PA unit, every 3 months, at the end of works in the unit or neighboring areas, and in the presence of an outbreak.

If the amount of CFU/m3is less than 0.1 the room qualifies SUITABLE to perform Bone Marrow transplant procedures. The presence of at least 0.1 CFU of*Aspergillus*sp. and Zygomycetes, and the presence of more than 10 CFU of*Penicillium*sp.

Maintenance and monitoring of isolation room ventilation systems:

Maintenance of air conditioning and ventilation systems is essential to guarantee adequate air quality, which is why the following must be verified:

- Quantitatively the number of air changes per hour. This is done by measuring the air injection and expulsion rates with properly calibrated anemometers.
- Negative differential pressure on a daily basis through visual indicators (non-polluting smoke tubes (glycerol), paper coil, etc.), even when there is a differential pressure sensor (for example: micromanometer).

- Ventilation systems must be in accordance with the recommendations of engineers and manufacturers to ensure optimal performance for adequate indoor air quality and thermal comfort.
- Verify the absence of avian colonization near air intakes or operable windows.

- Maintain air duct grilles according to specific procedures and when rooms are not occupied by patients.
- Clean ventilation ducts as part of routine maintenance.

1.3- Neonatology

The room should be closed and separate from the infirmary, with provisions for assistance and care separate from the general infirmary area.

- You must maintain a minimum renewal of outside air 2 times per hour, and 6 air changes per hour
- Recirculation with other areas is not recommended.
- The relative humidity must be maintained between 30 and 60% and the temperature between 22 and 26°C.
- The minimum filtration in the air injection must be greater than 90%: Low efficiency filters (G4) + Medium efficiency filter (F8) + UVC (air unit coil lamps).

- Natural ventilation is not recommended, nor the use of ceiling or pedestal fans due to the negative effect on the direction and flow of air.

IMPORTANT
Window or cassette type air conditioners in**critical areas are not recommended** since they are associated with outbreaks of fungal infections (dirt, humidity and bird droppings), in addition to the negative effect on the direction and flow of air, and spread between patients.**The ideal**is to eliminate these types of devices when planning renovations. If they should be used, take into account:

- Do not turn it off at the end of the day, switch it to ventilation mode.
- Set the indoor unit fan speed to its lowest speed.
- Place the air directors so that the air flow that comes out does not go directly over the patient.
- Cancel the wave movement of the air deflector.
- If it works in heating mode, place the air deflector upwards, if it works in cooling mode, place the deflector downwards.
- Periodically clean and disinfect the indoor unit filters according to the manufacturer's recommendations. To do this, it is advisable to use eye protection and face masks, and perform hand hygiene before and after the procedure.

2- Operating room

Ventilation in the operating room has special considerations due to the need to reduce the transmission of microorganisms, to extract odors, particulate matter and gases, to control high thermal loads, the need for specific equipment and processes, and different patients. Although 80 to 90% of the transmission of infections in the operating room is directly or indirectly through personnel or instruments, and around 20% may be due to airborne microorganisms; The air conditioning of this area is of great importance because it affects the distribution patterns of particles in the air, dilutes or concentrates them, moves them in or out of proximity to people, and accelerates or decelerates the growth times of microorganisms. Therefore, it is recommended that, to carry out a correct design of a ventilation system, an analysis is carried out according to the characteristics of the health establishment with the help of experts on the subject, and thus achieve a correct conditioning of the facility. For air conditioning purposes, operating rooms are classified into three groups:

- Class A operating rooms: organ transplant, cardiac surgery, vascular surgery with implant, specific traumatology, and neurosurgery. There are specific requirements to minimize the risk of infections and provide thermal comfort in operating rooms according to the ASHRAE 170 standard.
- Class B operating rooms: minor surgeries.
- Class C operating rooms: minor outpatient surgeries.

Temperature and relative humidity: The appropriate percentage of relative humidity in operating rooms is essential for the elimination of electrostatic charges and healthcare needs. It should be maintained between 40 and 60% and the temperature between 20 and 24°C. These values must be maintained throughout the time of use of the room.

Air renewal:

- Class A and B operating rooms: 20 changes/hour of the total room if there is a return, and 4 changes/hour of outside air.
- Class C operating rooms: 15 changes/hour of the total room if there is a return, and 3 changes/hour of outside air.

Airspeed: In class A and B operating rooms, and in order to ensure that there is no turbulence in the air, the speed in the so-called occupation zone or thermal strip must be around 0.20-0.30 m/s. should not exceed the upper value.

Air filtration: Air purification to filter all types of contaminants, including microorganisms, will be carried out in a phased manner. In each group of operating rooms, the three filtration stages will be carried out:

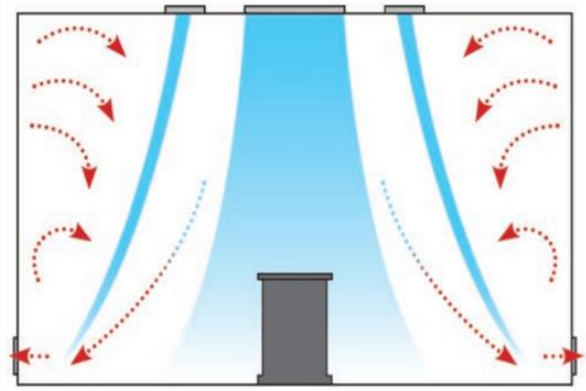
- Stage 1: Prevents the entry of particulate matter. In most cases this pre-filter is a disposable type.
- Stage 2: Medium efficiency filtration, 90% (F-8)

- Stage 3: Absolute filtration with HEPA, 99.97% efficiency, measured according to the DOP HEPA filter test.

In stages 2 and 3, the pressure drop must be measured with a differential manometer. Changing the filters does not depend on time but on the measurement of the pressure drop, which is in turn compared with a performance curve. These activities are carried out by hygienists or construction/ventilation specialists. This solution with absolute or HEPA filtration is recommended for operating rooms of all types.

Air distribution: Air distribution can occur with filtering cabins on the ceiling of the surgery room that incorporate H-13 absolute filters, their size and characteristics are associated with the injection air flow rate. Another air distribution can be with descending unidirectional laminar flow, this flow must cover the area of the patient and the medical equipment, at least 30 cm on each side of the surgical table. This area is known as the thermal strip, in order not to interrupt it and avoid turbulence, the unidirectional air distribution speed must be low (maximum terminal speed of 0.50 m/s). 65 to 75% of the air should be supplied by linear slot diffusers that should have a 5 to 15° outward inclination, and the remaining 25 to 35% of the air through laminar flow diffusers.

Air distribution:



Pressurization of the operating room: The supply and extraction air volumes must be selected to achieve positive pressures from highest to lowest, in accordance with environmental criteria and the classification of the different operating rooms. These will be overpressured in relation to the sectors adjacent to them, with the supply air flow being 15% higher than the extraction air. Measuring the differential pressure is critical to verify that the area meets the requirements for the type of procedure to be performed.

Constructive aspects of ventilation to consider

Ducts: The supply and extraction ducts must be metallic, constructed of galvanized sheet or stainless steel and their interior walls must be smooth without exposed internal insulation or roughness. These surfaces minimize friction and, therefore, the

accumulation of particulate matter. In addition, galvanized sheet metal contains zinc, considered a naturally antifungal element. Smooth surfaces facilitate mechanical hygiene, that is, internal cleaning. It is crucial that inspection and access covers are incorporated into the ducts distributed along their route. The inspection covers are the entry points to perform mechanical hygiene.
The duct joining system must have a perimeter flange, which houses a screw in each of its corners to guarantee the union. This minimizes air loss at the joints. At the same time, the incorporation of non-organic synthetic weather stripping in the joints favors the airtightness of the system.
It is important to highlight that ducts must be prevented from passing through the false ceiling of the operating rooms since their internal inspection or prophylaxis is not feasible in these watertight cavities.

Grilles or air diffusers: The exterior air intake grilles of the air conditioner and the air outlet grilles of the extractor must be far from each other, so that the air from the extractor does not influence that of the air conditioner. Distances must be at least 8 meters. The outside air intake of the air conditioner must be sufficiently far from the outlets of gases, smoke, bad odors or other sources of air disturbance. In addition, it must contain anti-gap mesh and a gooseneck, which inhibits the entry of rainwater or snow.

Operating regime of the operating rooms: In order to minimize potential contamination of operating rooms when they are not operational, it is recommended for operating rooms for scheduled and urgent surgeries that the air conditioning installation remains operational, being able to tolerate the decrease in delivery and extraction flows. air up to levels of 50% required, simultaneously. In the case of outpatient surgery operating rooms, the operation of the air conditioning can be stopped, and it must operate at least two hours from the end of the last intervention, and two hours before the start of the first daily intervention.

Monitoring
Regardless of the centralized and automated management systems, a display must be placed at the entrance to each operating room that indicates its temperature and relative humidity.

Microbiological controls:

In class B and C operating rooms: they are not necessary. In

class A operating rooms:

- They are carried out annually.
- Two tests are performed, one before starting the surgical activity and another immediately before finishing.
- They are carried out by impact and sedimentation techniques (plates located at the cardinal points). They will be done in duplicate. Surface sampling techniques are not recommended.

Equipment maintenance protocol

The air conditioning in the surgical blocks must serve technically managed and automated facilities. Consequently, in this type of installations the maintenance will differ from the classic one, so this control is recommended to be remotely managed, implying that all the operating, control, verification and measurement parameters, as well as their anomalies, will be provided in graphical form and written. Regardless of the maintenance protocol used, all installations must carry out preventive maintenance control.

3- Hospitalization room

Hospitalization rooms can be divided into three types: general, isolation and immunosuppressed.

3.1- General admission rooms

Three methods can be used to ventilate general admission rooms: natural, mechanical or hybrid.

Natural ventilation:

Natural ventilation without proper conditioning is the last resort when mechanical ventilation is not available. This is because, in the vast majority of cases, there is no adequate, constant and continuous way to prevent the filtration of exogenous contaminants into the establishment, including fungi, particulate matter, soot, combustion gases, etc. Furthermore, unconditioned natural ventilation reduces the possibility of controlling temperature and relative humidity in rooms where it must be controlled and adjusted. It is important to note that natural ventilation can alter the pressure cascade necessary in certain interior spaces, causing interior depressurization or overpressure with little or no mechanical control. Likewise, another of the limitations of natural ventilation is that it only works when there are natural forces such as wind or breeze, and when the air inlet and outlet openings are kept open, and this type of dilution cannot be implemented throughout the year. given the weather conditions (for example: winter or extreme heat). However,Under favorable weather conditions, opening fenestration points such as windows and doors has been shown to provide an average ventilation of 28 air changes per hour. Older facilities with opening windows and doors, built more than half a century ago, characterized by large windows and high ceilings (with higher values of the volume/ patient ratio), can achieve average ventilation of up to 40 changes per hour.to. From the perspective of contaminant dilution in indoor environments, the use of natural ventilation must guarantee the following average minimum ventilation rate per hour:

- 45m^3/h per patient for general hospital services and outpatient services.

- 2.5 l/s/m3for hallways and other passageways without a fixed number of patients. When patient care in corridors is necessary in emergency or other situations, ventilation rates should be the same as those required for airborne transmission prevention rooms or for general hospital services.

Mechanic ventilation:

This type of ventilation is the most recommended for health institutions since they allow ventilation control, being reliable in terms of supplying the air flow provided for in the design, regardless of variations in wind and ambient temperature. In addition, it can be easily integrated into air conditioning, and the temperature and relative humidity of the indoor air can also be regulated. On the other hand, filtration systems can be integrated into mechanical ventilation to eliminate microorganisms, particles, gases, odors and harmful vapors. Airflow channeling in ventilation systems can be guided, for example, by allowing air to flow from areas where there is a source (patient with an airborne infection) to areas where there are no vulnerable individuals.

Hybrid ventilation:

- Fans should be installed where room air can be evacuated to the environment through a wall or ceiling.
- The number and size of exhaust fans depends on the ventilation rate and it is mandatory to measure and test them before use.
- Air conditioning can be added: hot or cold.
- Another option is the use of wind turbine fans.

The rooms are divided into:**areas occupied by the patient**: patient bed and areas close to the beds, and**occupied zone**: which includes both the visiting area and the patient's rest area.

Conditions for ventilation in both zones:

- The temperature should be 25ºC and the relative humidity 40 to 60%.
- The fresh air flow must guarantee 2 renewals/hour and 72 m3/h per bed.
- The recirculated air flow must be at least double the fresh air flow. The room must have neutral pressure or depression with respect to the hallway.

Conditions in the area occupied by the patient:

- The temperature gradient between the upper and lower regions must not be greater than 2ºC.
- The air speed must not exceed 0.1 m/s.

Conditions in the occupied zone:

- The temperature gradient must not be greater than 3ºC between the lower and upper limits of the occupation zone.
- The air speed should not exceed 0.2 m/s in winter, nor 0.15 m/s in summer.

- Do not use table or foot fans in patient care areas or public areas.

- The use of ceiling fans can improve the circulation of outside air and prevent stagnation of air pockets in occupied spaces; they should not be used in closed places or where medication is prepared.

Room air conditioning:

- The use of inductor-type air-water systems is recommended to ventilate and condition the ambient temperature.
- Type systems*fan coil*They are not recommended unless the permitted noise level is not exceeded and the flow of fresh air is guaranteed.

4.1- Isolation rooms for infectious diseases: See characteristics in point 1.2.

4.2- Isolation rooms for immunocompromised patients: See characteristics in point 1.2.

5- Support room

5.1- Laundry

Laundries are sectors where a significant amount of particulate matter, natural and synthetic fibers, is generated. Likewise, they are areas where a high level of thermal load and humidity is usually incorporated due to the drying of the materials. In laundries that have large work surfaces, the natural ventilation of the rooms is more favorable for the development of workers. There are processes that require forced ventilation, or a suction system to extract toxic substances and clothing lint that collect in the environment. On the other hand, the dirty area must have a negative air pressure compared to the clean area, and have a ventilation system that allows more than 20 changes/hour. The work must be in one direction, from dirty to clean. It is important to take into account the quality aspects of the indoor environment in laundries, including environmental control of thermal load, lighting, ventilation and sound level.

5.2- Food

Food preparation areas present important aspects to consider since they are generally points of emission of steam and particles, including oil microdroplets. In addition to having combustion cooking, carbon monoxide, nitrogen oxide gases and sulfur product from the burning of natural gas must be considered. Also, you must:

- Maintain minimum standards of the conditions of the air that enters and leaves the environments.
- Renew the air depending on whether it is an environment with sources of heat or gas emissions, or, for example, a warehouse of finished products.

- Have positive or negative air pressure, depending on the sector in which you are working.
- Control odors, vapors, particular contaminants typical of each process and gas leaks. The mitigation and control of these factors is achieved by implementing different types of ventilation systems such as: air filtration, extraction hoods and dust collection.

5.3- Morgue

Necropsy rooms must have ventilation with a minimum of 12 air changes/hour, and at least two of the air changes must be outside air. The room must be negatively pressurized relative to adjacent areas.

5.4- Laboratory

Laboratories require special ventilation conditions, and it is essential that tasks that generate air pollution be carried out in extraction hoods. YesSome aspects and recommendations must be taken into account for the laboratory air outlet ducts:

- amount of air
- ventilation type
- air quality

Natural ventilation is not recommended, and mechanical ventilation, by injection, extraction or both, is necessary.

- The laboratory air outlet ducts must be separated from the rest of the building and be guided to the outside of the building at the level of the roof or ceiling, and away from the air flow.
- Air that has come out of any biological safety cabinet in the laboratory should not be secluded.
- The air outlet of the different sections cannot be combined into a single outlet.
- The installation of air inlets must be ensured to replace the one that is extracted in sufficient number and correct location.
- The air inlets must be distributed in such a way as to ensure good air distribution in all work areas.
- Avoid generating very strong air currents.
- It is recommended to have a minimum of 6 total air changes/hour in general technical areas.
- In areas where dangerous biological material and vapors are handled, it is recommended that the air outlet be in a single pass (in an outward direction), and a biological safety cabinet for biological material and a gas extraction hood must be used. for the management of volatile substances.

5.5- Pharmacy

Ventilation systems are needed to ensure the proper preservation of medications and medical devices. Due to technical requirements and in order to maintain an adequate temperature for the conservation of medications, it is necessary to incorporate air conditioning equipment.

- The minimum required exterior air renewals are 2 changes/hour, and 4 total changes/hour for the fractionation and preparation sector, while for the storage area it is 6 changes/hour.
- A thermohygrometer must be used to accurately verify the temperature and humidity conditions prevailing in the premises; excess humidity deteriorates medications classified as hygroscopic.
    - Ambient temperature: 21 to 26°C
    - Cool temperature: 8-15° C
    - Cooling temperature: 2-8° C
    - Maximum relative humidity accepted for the storage of medications: up to 67%.

Methods to verify adequate air quality

These tasks are known as “commissioning for existing buildings” and are usually carried out by environmental hygiene specialists. Verifying adequate ventilation takes into account the basic principles established by: US Center for Disease Control (USCDC), American Industrial Hygiene Association (AIHA) and American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Verification tasks include the measurement of air flow rates, the appropriate pressure cascade and its quantification. In addition, visual inspections of the ventilation systems must be carried out, including air handlers, treatment chambers, condensate trays, coils, dampers and injection, return and expulsion ducts. In general, the interior surfaces of ventilation systems must be free of dust, except in the case of return ducts, where a moderate level of particulate matter is allowed prior to the return air entering the filter bank. On the other hand, the condensate trays must be free of microbial growth, ensuring that the condensate water is clear and flows towards the drain. The interior of equipment and ducts must be free of visible fungal contamination and no unpleasant odors must be detected. The outside air intake must be free of obstruction and have no avian colonization (nests) or guano. (Annex IV)

Bibliographic references

1. Healthcare Infection Control Practices Advisory Committee (US). Guidelines for Environmental Infection Control in Health-Care Facilities: Recommendations of CDS and the Healthcare Infection Control Practices Advisory Committee (HICPAC). 2003. 235 p. https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmentalguidelines-P.pdf
2. Design manual for air conditioning and ventilation of operating rooms and rooms in hospital centers. Castilla y León. March 2011.
3. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. 2007-2017www.cdc.gov/ncidod/dhqs/pdf/isolation2007.pdf
4. Inter-institutional building recommendations to prevent the transmission of coronavirus or other respiratory viruses in health institutions or public buildings. Version 1. December 2020. SADI-ADECI-INE-AADIAH.
5. Saran S, Gurjar M, Baronia A, Sivapurapu V, Ghosh PS, Raju GM,*et. to the.*Heating, ventilation and air conditioning (HVAC) in intensive care unit. Crit. Care. 2020 May 6;24(1):1–11.
6. Ventilation of funeral home preparation rooms: guidelines and calculations. Trenton, NJ. New Jersey Department of Health and Senior Services (NJDHSS), 2006 Jan.

7.Standard 170-2021. Ventilation of Health Care Facilities (ANSI/ASHRAE/ASHE Approved).

8. Recommendations for the use of CO meters$_2$to evaluate efficiency in the COVID scenario of the ventilation pattern of the spaces. Occupational risk prevention department. Madrid.
9. Ventilation of environments and measurement of carbon dioxide levels. Argentine Ministry of Health. Transmission of COVID-19 by aerosols developed jointly between the Ministry of Science, Technology and Innovation and the Ministry of Health, with valuable contributions from researchers from public universities and CONICET.

10. Position Document on Indoor Carbon Dioxide. ASHRAE. February 2022.
11. Martín Salas C, Tordoya Titichoca IJ, Ezpeleta Baquedano C. Environmental microbiological control. Sick Infection Microbiol. Clin. 2016;34 Suppl 3:19-24. doi:10.1016/S0213-005X(16)30215-4.

ANNEX I:**Germs involved according to areas of altered structures**

	Aspergillus SP	*Cryptococcus*	*Histoplasma spp.*	*Mucorales / Rhizopus spp.*	*Scedosporium spp.*	*Penicillium spp.*	*Acremonium spp.*	*Cladosporium spp.*	*Sporothrix*
Funcionamiento inadecuado del sistema de ventilación	X			X		X	X	X	
Filtros de aire	X								
Palomas, sus escrementos y dormideros	X	X	X						
Ácaros de pájaros	X	X	X						
Marcos de filtros de aire	X								
Aires acondicionados de ventana	X								
Reflujo de aire contaminado	X								
Contaminación del escape / eliminación de aire	X								
Falsos techos o techos flotantes	X			X					
Aislamientos fibrosos y techos metálicos perforados	X								
Aislamiento de fibra de vidrio del conducto de ventilación	X					X			
Aislamiento acústicos	X								
Techos de placas de cartón/yeso (dunlop)	X			X					
Material inflamable	X								
Materiales de construcción de madera húmeda	X								
Apertura de puertas a sitios de construcción	X								
Construcción / remodelación	X				X				X
Ventanas abiertas	X								
Puerta del conducto de eliminación	X								
Aspirador hospitalario	X								

Annex II:**Maintenance Activity and Frequency**

Item	Code of Activity	Minimum Frequency*
Filters and air purification equipment	TO	According to the operation and maintenance manual
Outside air dampers and actuators	b	Every three months or according to the operation and maintenance manual
Humidifiers	c	Every three months of use or according to the operation and maintenance manual
Dehumidifier coils	d	Regularly when dehumidification is likely to occur, but not less than once a year or as specified in the operation and maintenance manual
Condensate pans and other adjacent surfaces subject to wetting	d	Annually during periods of cooling need or in accordance with what is specified in the operation and maintenance manual
Exterior air intake grilles, anti-bird meshes, drip eliminators and adjacent areas	AND	Every six months or as specified in the operation and maintenance manual
Sensors used for dynamic control of minimum outside air	F	Every six months or periodically according to the operation and maintenance manual
Air handling systems except for units below 2000 cfm (1000 liters/s)	g	every five years
cooling towers	h	In accordance with the operation and maintenance manual or treatment system supplier
Drains located in plenums, or rooms that serve as air plenums	Yo	Periodically in accordance with the operation and maintenance manual
Accessibility of equipment/components	J.	
Visible microbial contamination	K	
Intrusion or accumulation of water	K	

ACTIVITY CODE

TO	Maintain according to the O&M manual
b	Visually inspect or remotely monitor proper operation Cleaning and
c	maintenance to limit scale and microbial growth
d	Visually inspect for cleanliness and microbial growth and clean when fouling is observed Visually
AND	inspect for cleanliness and integrity and clean when necessary
F	Check accuracy and recalibrate or replace as necessary
g	Measure the minimum amount of outside air. If the minimum measured air flow rates are less than 90% of the minimum outdoor air flow rate indicated in the operation and maintenance manual, they will be adjusted or modified to exceed 90% or evaluated to determine if the measured flow rates conform to this rule.
h	Treat to limit the growth of microbiological contaminants
Yo	Maintain to prevent transport of contaminants from the floor drain to the plenum
J.	Keep the space provided for routine maintenance and inspection clear around ventilation equipment. Investigate and
K	rectify

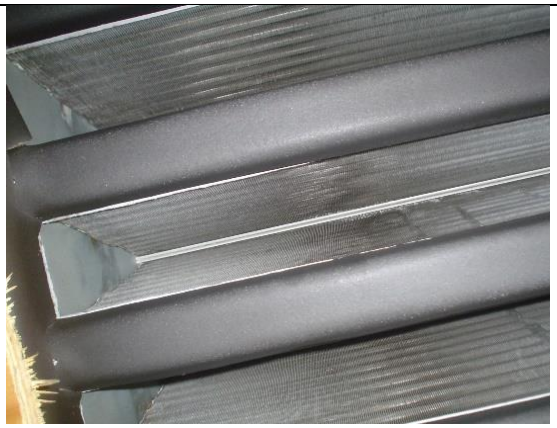
*Minimum frequencies may be increased or decreased if indicated in the operation and maintenance manual.

ANNEX III:**Summary Recommendations Ventilation according to areas**

Specifications	Units of critical care	NEO	Isolation Air – AP	Type operating room TO	Type operating room b
Air pressure	Positive, negative or neutral depending on the location of the service	Positive, negative or neutral depending on the location of the service	Respiratory: negative Protected environment: positive	Positive	Positive
Air change in room	≥ 6 spare parts air totals per hour	≥ 6 spare parts air totals per hour	≥ 12air changes per hour	≥20spare parts of air per hour	≥20spare parts of air per hour
Air renewal abroad	2 times/hour	2 times/hour	2 times/hour	4 times/hour	4 times/hour
Sealed	Yeah		Yeah		
System of filtration	- Minimal filtering (>90%): G4 + F8 .	Minimal filtering (>90%): G4 + F8	Filtered out minimum (>90%): G4 + F8 + H13	Minimal filtering (>90%): G4 + F8 + H13	Minimal filtering (>90%): G4 + F8 + H13
RH	40-60%	40-60%	40-60%	40-60%	40-60%
Temperature	21-24°C	22 to 26°C.	21-24°C	20-24°C	20-24°C
Sonority				< 40 dB	< 40 dB
Ventilation natural	NOT recommended	NOT recommended	NOT recommended	NO recommended	NO recommended
Flow direction			Unidirectional	Unidirectional	Unidirectional
Recirculation to other areas	I don't know recommends	I don't know recommends			

ANNEX IV:**Graphic images exemplifying the state of structures**

Streamers with microbiological growth



Streamers with proper hygiene

Contaminated condensate pan microbial

Condensate tray free of microbial contamination

Duct interior with fungal growth

Contamination-free duct interior

 Saturated filters	 Saturation-free filters
 Flexible duct with fungal growth	 Contamination-free flexible duct
 Duct interior with rust particles	 Duct interior free of particulate matter

Grill clogged with paper

Grille clogged with tape

Circular duct with particulate matter

Rectangular duct with particulate matter

SAFE WATER MANAGEMENT

Introduction:

Water is one of the essential elements to guarantee quality care in health institutions. Its use both for hygiene and for consumption is key. Wet reservoirs and water with chlorine concentrations lower than recommended can be a critical link in the development of healthcare-associated infections. This is why it is necessary to work on the prevention of reservoirs of microorganisms that are characterized by survival or proliferation in humid spaces.

The adoption of clear regulations, socialized and validated by the sectors and actors involved is a great need, especially due to the lack of guidelines aimed at all people involved in water issues. Having operation and maintenance programs for water and sanitation systems within health establishments, ensuring respect for protocols, the corresponding regulations and the provision of basic supplies is essential. To do this, the health facility must form a multidisciplinary team that works on the design and development of a specific water management plan for the buildings under its charge. Among its main responsibilities are the definition of activities, the implementation of an action plan with defined roles and the evaluation of its compliance.
This document aims to define the minimum guidelines to guarantee care with safe water in health institutions, both for consumption and for personal and environmental hygiene.

Current regulatory framework:

The quality of the water that enters the buildings, both from the network and through the property's own exploitation via groundwater, rainwater collection, etc.; It largely defines the actions to be taken to obtain an adequate result at the outlet of the taps or other distal points. With this premise, numerous examples can be cited of conditions resulting from poor quality of incoming water. For example, the World Health Organization (WHO) has estimated that 80% of all water-borne diseases are due to human exposure to drinking water, and more than a third of the deaths that afflict countries in developing countries are attributable, at least in part, to the lack of drinking water supply and adequate sanitation systems.
In Argentina, 39.35 million inhabitants have access to drinking water through the public network (water coverage is 85.4%) and 28.82 million people have toilet drainage to the public network (sewer coverage is 62.6%), according to the 2022 Census.

Legal and institutional framework for water and sanitation services in Argentina

The multilevel institutional environment for the provision of water and sanitation services in Argentina has its roots in policies and reforms dating back to the 1980s and 1990s. In 1980, the provision of drinking water and sanitation services was transferred to the 23 provinces, with the decentralization of the state-owned Obras Sanitarias de la Nación (OSN). In 1994, Argentina underwent a constitutional reform that introduced an environmental clause (article 124) that recognizes the historical right, according to which the 23 provinces and the Autonomous City of Buenos Aires (CABA) are owners of their water and have jurisdiction over she. They are therefore responsible for the provision of water and sanitation services within their own boundaries. Article 41 establishes that the National State can dictate minimum standards of quality and protection, which can be complemented by the provinces; This means that the National Government can establish a national water program or plan, but it needs the support of the provinces to implement it. In practice, there is no national water law or framework, and each of the 23 provinces and the CABA have their own water legislation, both in terms of resource management and water and sanitation services. Its powers include policy formulation and implementation, operational management, financing and regulation.

Water quality and safety standards

In Argentina, in relation to the quality of drinking water, parameters considered primary and secondary, both physical, chemical and bacteriological, have been established, thus aligning with the water control parameters recommended by the WHO. The companies or organizations in charge of water provision must guarantee the quality of the water supplied to users by verifying, through a systematic series of controls, that the levels are within the limits established in Annex A of the Regulatory Framework of Law No. 26,221. . Own analyzes and measurements must be carried out to promptly verify the quality of the service; these controls currently exclude the presence of *Legionella* sp. The Water and Sanitation Regulatory Entity (ERAS), in its "Guide to cleaning drinking water tanks" establishes that they must be cleaned at least once a year, as well as that the tanks must be airtight. closed to guarantee water quality.

While provincial regulatory authorities are in charge of quality control of drinking water and wastewater, compliance with bacteriological and chemical parameters and thresholds are defined at the national level (Food Code and regulatory standards). When there is no regulatory body, the provincial or municipal authorities are in charge of this control. Health establishments must be governed by the current regulations of the jurisdiction to which they belong, as minimum actions to guarantee water quality.

Water Management Plan:

Health facilities are complex structures that house patients, the majority included in those considered vulnerable groups due to their comorbidities; and health personnel. In order to prevent the possible risk of hospital-acquired Legionellosis or exposure to other pathogens (Annex I), it is recommended to implement a water management plan in all healthcare centers.

The development of this plan is an ongoing process that should be reviewed at least once a year. However, it should be reevaluated in the event of any of the following events:

- Controls are persistently outside established limits. A major water
- maintenance or service change occurs, such as:
  - Building modifications or new construction.
  - Team changes.
  - Changes in treatment products (for example: disinfectants)
  - Changes in the use of water or its source.
  - Changes in the municipal or own water supply.
- There is one or more cases of Legionellosis possibly associated with the institution's water system.
- Changes occur in laws, regulations or standards.

When a new event triggers a change, it is important to remember to update the process flow diagram, control points, established ranges for controls and corrective actions, and the water management program. Additionally, new training is recommended for personnel responsible for implementing and monitoring the updated program.

1- Formation of a work team

This is the first step to a water management program. It is recommended to form a multidisciplinary team made up of people from the institution and/or external people who are capable of supervising the program, knowing the health center's water system, identifying sites for controls and establishing ranges, identifying interventions, carrying out corrective actions, monitor the program, document program activities, corroborate performance and communicate program changes/activities.

The objective of this equipment is to ensure the safety of all water used in the facility both by patients/residents, staff and visitors, as well as in building operational processes, including cleaning, hygiene and equipment, thus minimizing the risk of infection associated with the water.

Members that are recommended to be included to form the water management program team in a health facility:

- Personnel who understand the establishment's accreditation standards process and qualification requirements according to the regulatory framework.

- Professionals with experience in prevention and control of infections associated with health care.
- Health professional with experience in infectious diseases.
- Quality program staff.
- Director/administrator of the institution.
- Hospital maintenance, engineering or architecture employees.
- Suppliers of equipment or chemical products.
- Contractors/consultants (for example: water treatment professionals).
- Hygiene and Safety at Work References.
- Microbiologists.
- Environmental health specialists.

This team must implement a training program for personnel involved in the control of the water system and its use, to ensure that they are properly informed and trained. Additionally, they must be evaluated for their competence.

2- Description of the water systems in the health center

The water system can be described in its entirety through texts or flow diagrams from its connection to the property until its final discharge, see the following diagram:

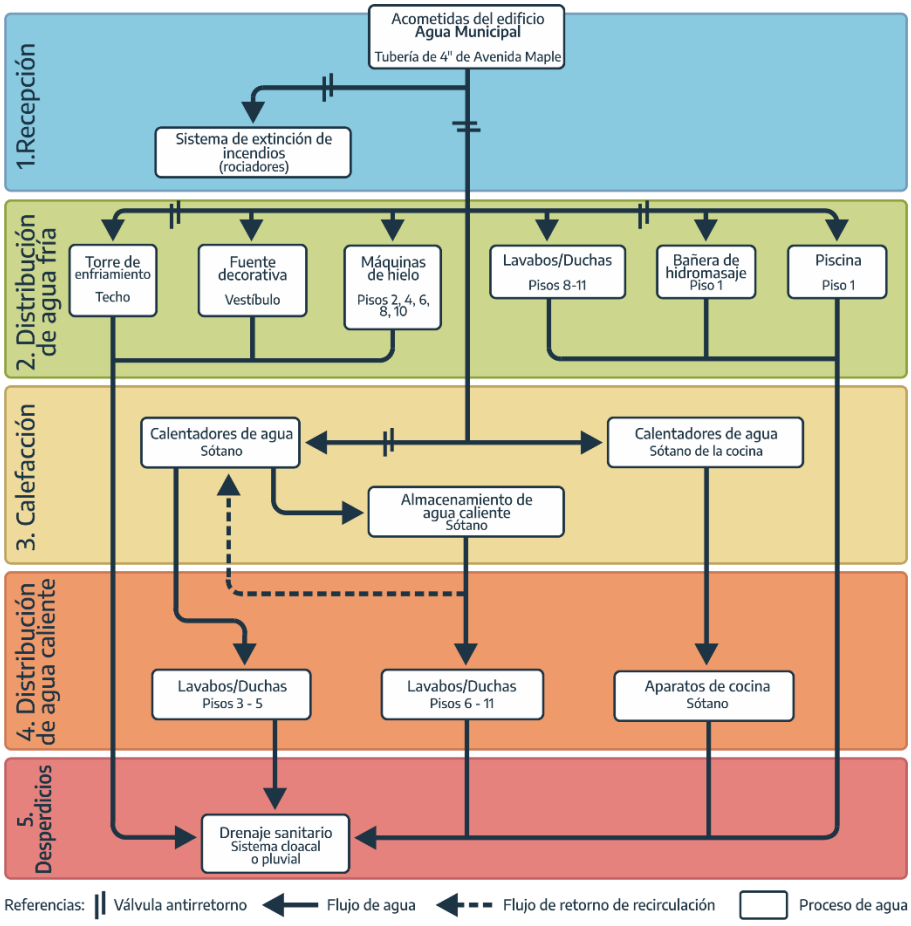


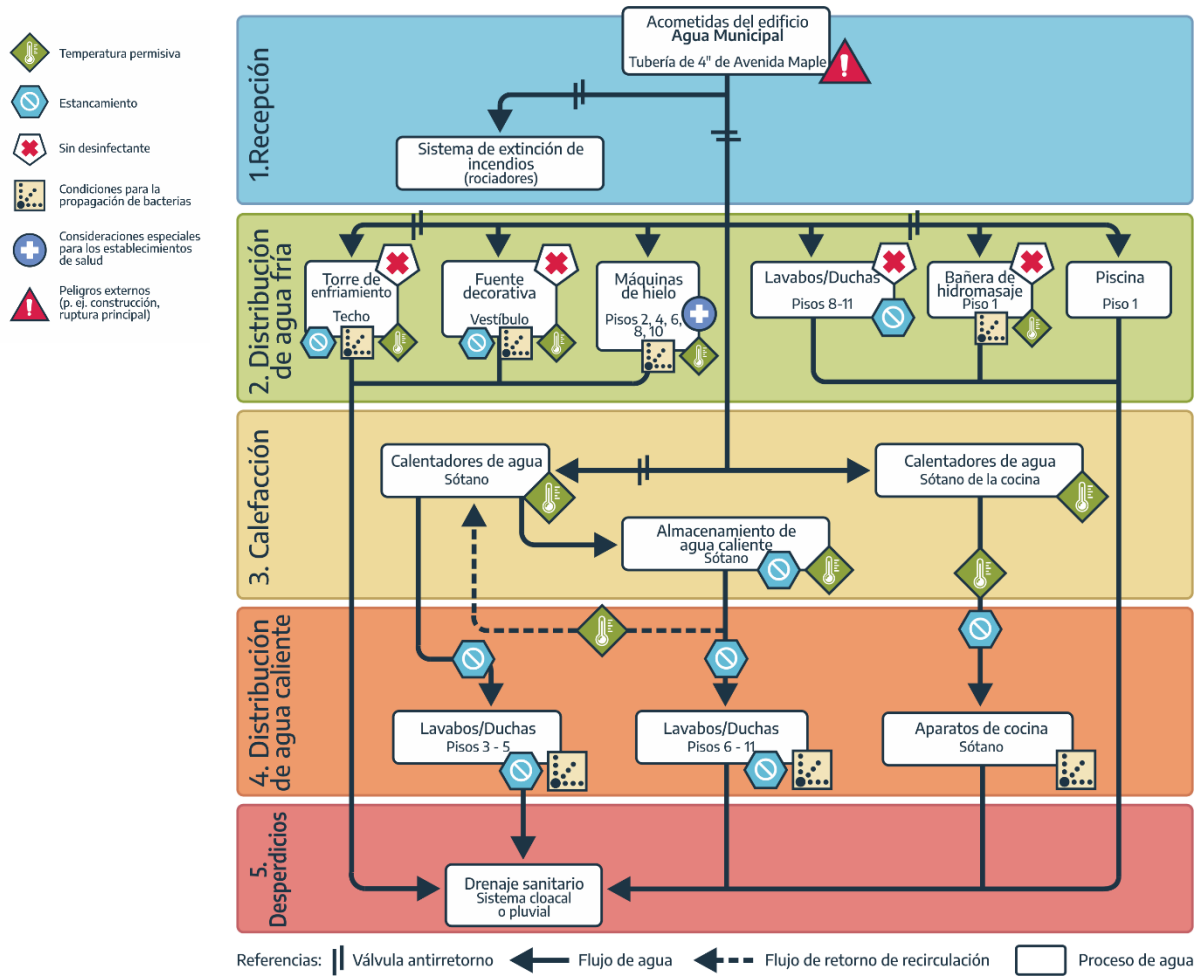
Diagram Considerations:

- "Municipal Water" can be considered as connected water depending on the building, for example: it can be a combination of well and network water.
- If rainwater is being used in the institution and indicate whether it is recovered for irrigation or drained into the storm drain.
- Instead of "Sanitary Drainage" it can be classified as a sewage or stormwater system. It is recommended that you add a simple description of your building's water system to these flowcharts, including the following points:
- Where the building connects to the municipal water supply.
- How water is distributed.
- The location of heaters or boilers.
- Patient care areas.
- Clinical support areas.
- Components and devices that can expose patients to contaminated water, for example: fountains.

- This description must be developed by the maintenance team of the
- establishment, using as-built construction plans of the security system
- plumbing. In the event that there are no plans according to work or project, they must be
- prepared by a competent professional to be integrated into the program.

3- Identification of areas where it can grow *Legionella* sp.

Once the water system diagram has been developed, it must be identified where potentially hazardous conditions are located. Each potentially hazardous condition must be addressed individually with a control point, measurement and limit. We can see this in the following diagram.



Special consideration should be given to:

- Areas where medical procedures may expose patients to water droplets, such as hydrotherapy,
- Rooms that emit water vapor such as bathrooms with showers, bidets and taps in general.
- Areas where patients are most vulnerable to infection, such as bone marrow transplant units, oncology, or intensive care units.

The risk assessment must identify potential hazards caused by *Legionella*sp., *Pseudomonas aeruginosa*and other pathogens, during the supply, storage, distribution, conditioning and use of water in health establishments. Once these potential risks have been identified, a next challenge appears:

prioritize. The severity of the risk must be assessed in order to establish priorities for risk management. The risk assessment must consider:

- Probability.
- Severity of hazardous conditions based on the type, scope and frequency of the events they may cause.
- Vulnerability of exposed people.

That is, although several conditions are found that may be risky and threaten water quality, not all of them will represent a high risk. The goal should be to distinguish between high and low risks so that attention can be focused on mitigating risks that are most likely to cause harm.

There are 5 risky conditions that should be looked for in the water system:

1.Warm water: Places where the water temperature may be conducive to bacteria growth.

2.Stagnation: Places where water stagnation and excessive "water age" in the pipe can promote microbial growth.

3.Lack or deficiency of disinfectant: places where the concentration of disinfectant is below effective levels.

4.Bacterial Spread: Places where the water system or a particular component encourages the growth and spread of bacteria.*Legionella*sp. (for example: sinks or showers).

5.External Hazards – Locations where a breach in the water supply may occur outside the control of your water management team, such as mains water supply.

4- Control Measures and Corrective Actions

It is important to establish ways to intervene when control limits are not met. It is necessary to consider that the monitoring results will vary over time and plan in advance what the corrective actions will be, that is, those that are taken in response to systems that are carried out outside the control limits.

For example: Unoccupied apartment

The eighth floor of the building is being renovated and will be closed to the public for a time. A member of the Operations and Maintenance team determines that these conditions may cause a dangerous situation because water use has decreased, meaning stagnation is possible. After sharing the situation with your supervisor, the prescribed corrective actions are incorporated into the plan.

A routine purging plan is initiated by opening all distal points (faucets, bidets, showers, etc.) routinely throughout the job to counteract the potential for stagnation.

According to the established plan, the frequency of measuring temperature and chlorine levels on the eighth floor is increased from weekly to daily for the duration of the renovation. The method is documented and your daily temperature and chlorine readings are recorded in a book

register. The documentation is reviewed with the supervisor, who presents the findings to the prevention team in scheduled meetings.

Even the most monitored systems will require adjustments. The concept is to be prepared to respond, even to unexpected problems, based on your knowledge of buildings' water systems, and how they grow and spread.*Legionella*sp. (Annex II). You may need to initiate action against a custom contingency to gain control of a building's water system. These actions can involve several steps and often require follow-up. Corrective action is always required when there is a building-related case of Legionnaires' disease, although it may also be appropriate in other situations.

5- Verification

Once the water management program has been developed, its effectiveness must be verified. The team should establish procedures to confirm, both initially and on an ongoing basis, that the water management program is being implemented as designed. Individuals should not verify program activity for which they are responsible.

6- Validation

The program team must establish procedures to confirm that the water management program effectively controls hazardous conditions in the building's water systems.

In summary, it is important to document and communicate all activities in your water management program. The written program must include at least the following:

- Program team, including names, titles, contact information, and roles on the team.
- Description of the building, including location, age, uses, and occupants and visitors.
- Description of the water system, including a general summary, water uses, aerosol generating devices, and process flow diagrams.
- Control measures, including points in the system where critical limits can be monitored and where control can be applied.
- Confirmation procedures, including verification steps to demonstrate that the program is being met.
- Document the sample collection and transportation methods, and which laboratory will perform the tests.

It is important to communicate to the entire institution's team about the existence of the program and train those responsible for implementing and monitoring it. This communication is, in turn, an opportunity to identify strategies to improve the management and efficiency of your water systems.

Calculations of water levels needed per day

In the event of damage or interruptions in the water supply, a contingency plan must be in place to guarantee health care. To do this, the necessary liters of water must be estimated, according to the requirements of the type of activities and patients treated at the health facility. The following WHO table can be used as an estimated guide for the minimum volume of water needed in a day of care.

Amount of water used in healthcare facilities (WHO, 2006)

Area	Amount
Outpatient	5 liters/consultation
Hospitalized patients	40-60 liters/patient per day
Operating room or obstetric unit (UO)	100 liters/intervention
Dry complementary feeding center	0.5-5 liters/consultation
Wet complementary feeding center	15 liters/consultation
Inpatient Feeding Center	30 liters/patient/day
Cholera treatment center	60 liters/patient/day
Severe acute respiratory syndrome (SARS)	100 liters/patient/day
Viral hemorrhagic fever (VHF) isolation center	300-400 liters/patient/day

In addition to the preventive measures mentioned above, in the following annexes you will find specific information for the prevention of microorganisms that may be present in humid reservoirs.

Bibliographic references

1. Toolkit: Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings. https://www.cdc.gov/legionella/wmp/toolkit/index.html
2. Technical guide for the Prevention and Control of Legionellosis in facilities. https:// www.sanidad.gob.es/ciudadanos/saludAmbLaboral/agenBiologicos/guia.ht m
3. Health Technical Memorandum 04-01: Safe water in healthcare premises. Part B: Operational management. https://www.england.nhs.uk/wp-content/uploads/2021/05/DH_HTM_0401_PART_B_acc.pdf
4. https://bancos.salud.gob.ar/recurso/legionelosis-recomendaciones-para-laprevencion-vigilancia-epidemiologica-y-control-de
5. Guidelines for the prevention and control of infection from water systems in healthcare facilities. Prepared by the Prevention and Control of Infection from Water Systems in Healthcare Facilities Sub-Committee of the HPSC Scientific Advisory Committee. Ireland. http://hdl.handle.net/10147/578778
6. Review. The role of hospital environment in transmissions of multidrug-resistant gram-negative organisms. Po Ying Chia,*et. to the*. Chia,*et. to the.*Antimicrobial Resistance and Infection Control. (2020) 9:29. https://doi.org/10.1186/s13756-020-0685-1
7. The Hospital Water Environment as a Reservoir for Carbapenem-Resistant Organisms Causing Hospital-Acquired Infections—A Systematic Review of the Literature. Alice E.*et. to the.*Clinical Infectious Diseases. 2017;64(10):1435–44
8. The hospital environment and infections. Role of the hospital environment and equipment in the transmission of nosocomial infections. Lorena López-Cerero. https://www.elsevier.es/es-revista-enfermedades-infecciosas-clinical-microbiology-28article-role-of-the-hospital-environment-equipment-S0213005X13003108
9. https://iris.paho.org/bitstream/handle/10665.2/4341/Guia_para_la_vigilancia_del_agua_VERSION_WEB.pdf?sequence=1&isAllowed=y
10. https://isid.org/guia/prevencion/higienemanos-2/

ANNEX I:**Other waterborne microorganisms: Multiresistant Gram Negative Bacilli (MRGB) and wet reservoirs**

Generalities

Sanitary water distribution systems can serve as reservoirs where microorganisms multiply or remain viable, mainly fungi and bacteria, including BGNMR.

The most frequent microorganisms (MO) associated with waterborne infections in health institutions are:*Legionella*sp. and*Pseudomonas*sp. and less frequently *Acinetobacter*sp., other non-fermenting BGN (BGNNF), enterobacteria, nontuberculous mycobacteria and *Cryptosporidium*sp.

In recent years, there have been many reports showing and associating the persistence of BGNMR in the hospital environment and subsequent transmission, giving great importance to environmental hygiene.

Classically, it has been considered that the transmission of microorganisms from these reservoirs to patients occurs due to:

- direct contact (showering patients with central catheters, hydrotherapy).
- ingestion of water and/or ice.
- indirect contact (reprocessing of devices, for example: endoscopes).
- inhalation of aerosols.
- aspiration of contaminated water.

To these transmission modes we should add:

- Contamination of surfaces and hands of staff by aerosols created from contaminated sinks or drains.
- Transmission of bacterial endotoxins through the dialyzer membrane in hemodialysis machines.

The most common sources of wet reservoirs in healthcare institutions are: the water supply network and associated equipment, including sinks and taps; water storage tanks and sewage drainage systems.

Sanitary facilities present areas of stagnation and corrosion, variable loads of nutrients and microorganisms, and ideal temperatures to promote bacterial colonization and biofilm formation. From there, there is evidence that shows retrograde colonization from the sewage system to sinks, showers and bathtubs, where, in addition to the colonization of these elements, aerosolization occurs when using said water systems up to 1 meter away from them.

The waste eliminated in sinks and drains provides the necessary nutrients for the formation and maintenance of the biofilm that functions as a reservoir of BGNMR. These BGNMR are not contained within the institution and can be disseminated to the community through the sewage system.

The use of tap water poses a risk of acquiring infections due to these BGNMR when used in direct patient care, as a diluent of solutions, as a source of water for different medical equipment, and in the final stages of high-level disinfection of medical instruments.
It is also important to remember that many BGNNF have very low nutritional requirements, can reproduce in distilled water and tolerate a wide variety of environmental conditions.

Different measures recommended to avoid the transmission of MRBG through wet hospital reservoirs

Pools or sinks and supplies for hand hygiene:

- They must be exclusive for hand hygiene and be separated from those used for other purposes. (for example: disposal of fluids, medications, breast milk, food, cleaning of equipment). This is to reduce the risk of colonization of the cloacal system with MRGB and to avoid providing media conducive to its development.
- They must be in sufficient quantity and appropriately located to facilitate adherence to hand hygiene, and they must be of sufficient size and depth to minimize splashes.
- In pools that are not in use, the taps must be opened daily.
- Containers of soap for hand hygiene or hydroalcoholic solutions should not be refilled. If it is necessary to fractionate this type of solutions, there must be an established protocol, supervised by the hospital pharmacy.
- Do not store medical equipment or materials near sinks to avoid contamination from splashes.
- Under the sinks or sinks, the area must be free of materials to avoid potential contamination due to damage to the drainage system. **Special considerations in Neonatology**
- Use distilled water to clean the skin of Preterm Newborns (PNU) under 28 weeks and other patients located in incubators.
- If an outbreak or increased incidence of waterborne OM is detected, distilled water should be used to bathe all at-risk NBs, even those who are not in incubators (less than 1500 g, intubated, with other invasive devices).
- In those incubators in which humidification is carried out, sterile water must be used. Water reservoirs should be changed every day. If they are reusable, wash and sterilize between uses.
- Breast milk and/or milk formulas should not be thawed or heated with unboiled tap water.

Clinical procedures

- Sterile water should be used to clean non-intact skin and mucous membranes of all patients (with the exception of chronic leg ulcers).

- Sterile water should be used to administer any medication or for any treatment that requires water (IV medication, nebulizers), and for humidifiers in ventilatory circuits.

Water dispensers/ice machines

- The external part must be cleaned daily. The internal part of the circuit must be cleaned at least once a month to prevent the formation of biofilm.

Equipment and environment

- The water used for the final rinse of endoscopes and for hemodialysis must have periodic microbiological controls.

Outbreak Management

Definition: An outbreak due to waterborne microorganisms is defined by the presence of 2 or more cases of invasive infections by the same microorganism, epidemiologically related.

In case of *Legionella* sp. and *P. aeruginosa* multiresistant is considered an outbreak with a only in-hospital case.

General measures:

- Establish an outbreak management team, made up of: a medical and nursing representative from the sector of the affected institution, managers, IACS control team, bioengineering/maintenance team, microbiology, epidemiology, hygiene and safety, committee team of risks.
- Develop a communication strategy and inform patients and families.
- Provide help, support and guidance to individuals involved.

What to investigate about the Index case and the secondary cases:

- Date of onset of symptoms.
- Type of infection.
- Risk factors: invasive devices, surgeries, etc.
- Comorbidities.
- Other colonized people.
- Evaluate the need for retrospective studies.
- Contacts.

Infection Control Measures:

- Isolation if required.
- A sample will be taken from all patients considered at risk (screening). The best biological sample available will be evaluated depending on the case.

- Depending on the case, environmental samples will be taken from those sites that are suspected of acting as reservoirs. Before taking a sample, consult with the industrial or environmental hygiene specialist or microbiologist to define amplification sources, sampling points, type of sampling and appropriate sampling technique.
- Strengthen the cleaning and disinfection of all areas involved in the outbreak. Retrain personnel who perform this type of tasks. Evaluate whether the cleaning products used are effective in eliminating the OM causing the outbreak.
- If there is strong suspicion that tap water is the source of infection, perform dry hand hygiene, place filters at the end points of taps, use sterile water instead of tap water to bathe all patients and clean their around.
- Consider using sterile water to bathe high-risk patients (less than 1500 g, invaded) until tap water is excluded as a source of infection. This measure can be extended to all patients in the unit.

Environmental Measures:

There are different strategies proposed to manage contamination of sanitary water facilities:

- Cleaning and disinfection of the water network, using different strategies to treat it, for example: use of acetic acid solution or sodium hypochlorite.
- Installation of filters at points of use.
- Replacement of plumbing and/or sink accessories; replacement of reservoirs (sinks, drains) and/or redesign thereof; monthly replacement of jet stop membrane, and replacement of siphons every 3 months

Research Monitoring:

- Analyze any changes in practices, products, furniture that may be related to the outbreak.
- Review potential risks associated with the use of invasive devices in the affected area.
- Review potential risks associated with the water system in the affected area.
- Review bed occupancy rate and nursing/patient ratio.
- Check space between beds/incubators/cribs.
- Analyze results received from patients, environment and water
- Monitor the effectiveness of measures and ensure that preventive measures have been implemented.
- Declare the end of the outbreak as appropriate, giving feedback to the personnel involved and generating a final report.

ANNEX II:**Protocol for the collection of environmental samples for culture of *Legionella*sp. during the investigation of a cluster of cases or outbreak associated with health care**

Previous considerations:

It is important to note that sampling should only be carried out after a complete environmental assessment and the completion of a sampling plan.
The mode of transmission*Legionella*sp. It is through inhalation of aerosols, as well as aspiration of water contaminated with this microorganism, has also been described as a mode of transmission.
The personnel in charge of preparing the sampling plan and taking samples in a water system implicated as a source of infection must comply with all occupational safety and health procedures.
Precautions should be taken to avoid exposure to aerosols generated during sampling. Even slow-flowing streams of water can produce aerosols; therefore, when taking water samples, an N95 face mask should be worn to minimize exposure. Additionally, exposure to aerosols of patients or facility staff should be avoided. In the case of sample extraction in indoor environments, verify adequate ventilation of the enclosures, both for air extraction and injection, in addition to opening the fenestration points to the outside to increase passive ventilation.

Precautions should also be taken when taking compost or soil samples, to avoid inhalation of particles. When sampling this type of material, a properly fitted dust mask should be worn, protecting both the mouth and nose. Ideally, protective goggles should also be used.
In all sampling cases, the personnel in charge must wash their hands and dry them after taking the sample and before eating, drinking or smoking. The person in charge of the sampling process must receive training in risk management and risk control.*Legionella*sp., and must be trained in the correct use of stairs, to prevent falls when moving in air spaces. Protective clothing and N95 face masks should be worn to avoid contact or inhalation of unusual material.

Objectives of environmental sampling:

- Confirmation or exclusion of the site implicated as a source of infection. Identification of the
- state of the site, in particular material, and if it requires replacement or operational modifications.
- Risk assessment of the water systems involved. Differentiation between local or
- systemic colonization in the water system. Control of temperature, pressure and flow of
- water in the distribution system. Selection of the most appropriate strategy for the
- control of*Legionella*sp. in the place.

Preparation of equipment and materials:

- Sterile 1000 ml bottles containing 200 mg of thiosulfate to neutralize traces of chlorine or other biocide with halogenic composition present in the sample. 0.1N solution
- of sodium thiosulfate ($Na_2Yes_2EITHER_3$) (15.81 g/l in distilled water, sterilized by filtration, expiration every 12 months).
- 15 ml sterile plastic tubes with screw cap for biofilm swabs. Disposable
- polypropylene/Dacron tipped swabs with wooden or plastic stems. DO NOT use cotton-tipped swabs because they inhibit the growth of *Legionella* sp. Markers/Labels
-
- Sterile 500 or 1000 ml plastic bottle to measure chlorine level, pH and temperature.
- pH test kit with its corresponding verification standards in a pH range between 4.7 and 10.
- Chlorine test kit sensitive enough to detect chlorine levels below 2 ppm and up to 10 ppm with corresponding field calibration standards.

- Measuring Free Chlorine or Total Chlorine: Free chlorine can be measured when chlorine is known to be the disinfection method (as opposed to monochloramine, bromine, or other disinfectant), otherwise measuring total chlorine.
- Calibrated thermometer, range 10°C to 100°C.
- Forms where you can collect field data.
- Transport container with refrigerants that holds 1000 ml bottles, 15 ml tubes, thermometer, pH and chlorine test kits.
- Plastic bottle with freshly prepared disinfectant, for example: 1/10 dilution of sodium hypochlorite.
- Paper towels and towels soaked in alcohol.
- Necessary personal protection elements (Gloves, gowns, N95 face masks)

- Maintenance items (ladder, screwdrivers, tools, etc.)

Identification of areas where it can be found *Legionella* sp.:

The sampling sites chosen must be representative of all identified risk areas where *Legionella* sp. can survive and proliferate. The criteria for choosing the sites to sample depends on the nature of the facilities. For large installations multiple samples may be needed. To begin, the facility should be examined to establish all systems that use water with the following considerations in mind:

- Connection to the network building.
- Cisterns and storage tanks.

Additionally, examine areas that contain water at temperatures appropriate for the development of *Legionella* (greater than 20°C and less than 60°C), or with cross contamination between stagnant water and flowing water, or sites in which aerosols can be formed that are released into the environment, or sites that contain vegetation or accumulation of dust and land.

All water storage tanks, hot water reservoirs, vaporizers, humidifiers and any water distribution system where recirculation or reservoirs where water can reach temperatures greater than 20°C but less than 60°C, should be considered sources. potentials for the development of *Legionella* sp. Contamination can occur during building construction activities or building alterations. When investigating sources of exposure for cases of legionellosis, it should be determined whether there has been plumbing activity or construction work in or near the building involved.

Sampling plan:

- Establish the position of all master tanks, water heaters and storage cisterns, as well as the positions of all hot water outlets (faucet, showers, etc.) and determine which tank or heating system they come from. Perform the same procedure for cold water. Once the distribution diagram has been made for both hot and cold water, decide where the samples will be collected.
- Inspect the pipes and take note of the materials of both the pipes and the water outlets (copper, galvanized, steel, PVC, etc.).
- Inspect the heating systems and take note of the type of system: electric or gas.

-Drinking water sampling at points of use:

In most situations, it is appropriate to sample only hot water. However, there are situations in which it is useful to take some samples of cold water, or in cases in which the cold and hot water pipes circulate in certain proximity, or are not properly insulated to avoid heat transfer from the hot water to the cold water by convection or thermal radiation, especially in uprights. It is also common in summer, and particularly in the center and north of our country, where cold water can be hot enough for rapid amplification of *Legionella* sp., especially if the storage tanks or pipes are exposed to solar incidence. Desalination can also raise the temperature of cold water.

GENERAL CONSIDERATIONS: open the faucet and let the water flow for at least 30 seconds before collecting the sample.
Collect biofilm with a swab and a water jet sample from each site.
sampling (i.e. each shower head or faucet). For showers, ask the staff

maintenance of the facilities to remove the shower, for the taps ask that the aerator be removed.

Storage and transportation:

Move the samples at room temperature and protected from light within 24 hours after collection. If shipping to the processing site is delayed, keep and send refrigerated at 10ºC, DO NOT freeze.
All bottles and/or swabs must be labeled with detailed information on the collection site and whether it is the first or second squirt.

Bacteriological examination:

According to the microbiological characteristics of the water samples, the following procedures are suggested:

Features of the sample	Suggested procedure		
High count bacterial (swabs, Non-potable water)	Pretreatment acidic or thermal	0.1 sowing ml in plate BCYE* agar	Incubation: 35°C, 2.5% CO_2. Check days 4 and 7
Moderate count bacterial (tanks hot water, non-potable water)		0.1 seeding ml in plate BCYE agar	Incubation: 35°C, 2.5% CO_2. Check days 4 and 7
Low count bacterial (water potable)	Concentrate by filtration	0.1 seeding ml in plate BCYE agar	Incubation: 35°C, 2.5% CO_2. Check days 4 and 7

* BCYE: Buffered Charcoal Agar and Yeast Extract

Culture media for the recovery of *Legionella* sp.

Buffered charcoal and yeast extract (BCYE) agar containing 0.1% alpha-ketoglutarate is the base medium used for recovery of *Legionella* sp. from environmental and clinical samples. The most commonly used media in processing environmental samples include two types of BCYE agar supplemented with antimicrobial agents. The first, called PCV, contains polymyxin B, cycloheximide and vancomycin. The second, GPCV, is identical to PCV except for the addition of the amino acid glycine. PCV without L-cysteine (PCV (-)) can be used as a negative control medium. If the antimicrobial mixture is not available, acid and thermal decontamination can be carried out prior to sowing.

Although most of *Legionella* sp. They grow easily on BCYE, some species require supplements such as bovine serum albumin to improve growth. *Legionella micdadei* and various strains of *Legionella bozemanii* develop better in BCYE with 1.0% serum albumin

Planting procedure:

For each filtered water sample:

1- After vortexing the filter, inoculate one plate of BCYE, 2 of PCV and 2 GPCV and 1 PCV (-) with 0.1 ml of the suspension each, and spread with a sterile loop or a plastic rod sterile disposable.

2- Incubate the plates at 35°C in a jar with a candle or in a humidified incubator with an atmosphere of 2.5% CO_2. 3- Store the sample at 4°C. Acid treatment:

For some water samples with high concentrations of bacteria, it is necessary to use a selective procedure to reduce the number of non-bacteria. *Legionella* before cultivation. Acid treatment and heating of samples are commonly used for this purpose. *Legionella* sp. It is more resistant to lower pH and brief exposure to higher temperatures than many other freshwater bacteria.

1- Place 1.0 ml of the vortexed suspension in a sterile 15 ml conical tube containing 1.0 ml of acid buffer and mix.

2- Incubate the acidified suspension for 15 minutes at room temperature (can be extended to 30 minutes if the plates grow too large after the initial 15 minute treatment).

3- Place 0.1 ml of the suspension on BCYE, PCV and GPCV plates and spread with a sterile glass rod or a sterile disposable plastic spreader.

4- Incubate the plates at 35°C in a jar with a candle or in a humidified incubator with an atmosphere of 2.5% CO_2. Examination of crops:

1- Examine all cultures after 72 to 96 hours of incubation. Suspicious colonies are convex and round with entire edges. The center of the colony is usually bright white with a textured appearance that has been described as "cut crystal-like" or mottled. The white center of the colony is often bordered with blue, purple, green, or red autofluorescence. Closer examination of the primary isolation plates with long-wave ultraviolet light can easily detect these fluorescent colonies.

2- Suspicious colonies can be quickly identified by MALDITOF-MS. The colonies identified as *L. pneumophila* either *Legionella* sp. They must be subcultured and sent to the National Reference Laboratory (LNR) of the INEI-ANLIS "Dr Carlos G. Malbrán" for confirmation of the identification and genomic studies. Choose 2 to 4 representative colonies per water sample.

If MALDITOF-MS is not available, subculture each suspicious colony on a BCYE agar plate and on blood agar. If there is development on blood agar, it can be ruled out. *Legionella* sp. If no growth is detected on blood agar after 24-48 hours, continue the incubation of the BCYE agar until development is observed and refer to the LNR for confirmation.

3- Since *Legionella* sp. is a relatively slow-growing bacteria, negative plates should be re-incubated up to 10 days after inoculation, and continue to be examined for colonies. Discard the plates after the tenth day.

CONSTRUCTION MANAGEMENT

Introduction:

Maintaining health facilities in optimal conditions is essential to guarantee the quality of care provided. While construction activities anywhere can pose a risk to a population group, the location of these activities within healthcare facilities presents unique risks due to the number of people at risk in a single location.

Multidisciplinary work through the planning, coordination and monitoring of construction, renovation, repair, excavation and demolition activities in hospitals and health centers is essential to identify best practices so that the hospital environment is safe, and does not constitute a factor that increases the risk of infections in patients with deficient immune systems, susceptible patients, users of the health system and workers in general.
This document sets out recommendations to provide safe environments, including characteristics and use of protected environments, the definition of critical processes, clinical equipment intended for patient care, and suggestions for areas to supervise.

Infection control risk assessment and mitigation recommendations are essential components of infection prevention and patient safety programs. Before carrying out repair, demolition, construction or renovation activities, it is necessary to carry out a risk assessment from infection control, to identify possible exposures of susceptible patients to dust, humidity, and determine containment measures. This evaluation must focus on the type of construction, or repairs in the work area and adjacent service areas, such as warehouses and circulation corridors. Unit relocation of immunocompromised patients to other areas of the facility that are not affected by construction dust may be necessary. Evaluation and planning are important, these preventive strategies allow changes in infection rates and patterns to be monitored during and after construction, renovation or repair.

Multiple studies have shown the increase in the incidence of invasive fungal infections in health institutions exposed to activities related to construction, including not only those carried out within the institution, but also in the areas surrounding it.
Construction sites have been linked to outbreaks, caused by opportunistic microorganisms (fungi and bacteria) around the world, when planning and risk mitigation are ignored or ineffective. External air contains about 1 CFU/mm3 of*Aspergillus*sp. The environmental counts of*Aspergillus*sp. increase at the expense of

construction, demolition, renovation and removal activities. Outbreaks of aspergillosis have been reported among cancer patients attributable to the depressurization of the building that housed the hematopoietic stem cell transplant unit, while construction was underway in an adjacent building.
The population at highest risk of infection is usually immunocompromised due to an underlying disease or associated treatments (immunomodulators, chemotherapy). The diversity of materials used in construction brings with it pollution problems every time demolition work and/or breaking of the material surface is carried out. The suspended dust generated becomes a risk agent both for the health of patients, health personnel and workers in general, and for the normal functioning of the installed equipment.

Goals:

Provide an application tool to minimize the risk of infections during construction, renovation, repair and maintenance work in the healthcare field. **Specific objectives**

- Identify risk factors according to the characteristics of the work under construction, demolition or remodeling.
- Establish specific guidelines for the prevention and control of infections.
- Provide tools for monitoring works and compliance with recommended measures.
- Reduce the risk of spread of microorganisms in places surrounding construction or remodeling works.

Key concepts:

The classification of the types of dust generated in construction according to the generic composition, such as dust with or without Silica, wood, nano materials, metals; It is attached in Annex I.

Construction types: They are defined by the amount of dust they generate, the duration of the activity and the heating, ventilation and cooling systems.

- **Type A :**jobs**non-invasive**and that they do not generate dust. Includes, but is not limited to, removal of ceilings for inspection, non-scraping painting, electrical work, plumbing and any activity that does not generate dust or require cutting walls or access to ceilings except for inspection.
- **Type B** : activities of**small scale, short duration**and moderate to high dust generation. Includes, but is not limited to, the installation of telephone systems and computer wiring.
- **Type C** : activities that generate**moderate to high dust level**or require demolition or removal of fixed structures. Includes, but is not limited to,

scraping walls for paint or wallpaper, removing flooring, ceiling panels, wall construction, minor duct wiring work or ceiling electrical work, major wiring work, and any other activity that cannot be completed within one shift of work. **Type D** : projects of**demolition**and**Big works**. Includes, but is not
- limited to, activities requiring continuous work shifts, large demolitions or complete ceiling removal, and new construction.

Definition of risk groups

CLUSTER	RISK	PLACES
Group 1	Low	Administrative offices, cafeteria.
Group 2	Medium	Outpatient care area, rehabilitation, neurophysiology and admission offices.
Group 3	High	Emergencies, diagnostic imaging, post-anesthesia rooms, pre-delivery room, nursery, pediatrics, outpatient surgery, nuclear medicine, echocardiography, laboratory.
Group 4	Maximum	Transplant units, operating rooms, cardiovascular recovery, delivery and cesarean section rooms, oncology, Critical Care Units (ICU, OCU, PICU, neonatology), catheterization and angiography areas, oncological dialysis, anesthesia room, endoscopy rooms, sterilization, pharmacy.

Development

Any activity of expansion, construction, demolition, renovation or removal of building structures must be communicated by the area that leads the project (Annex II), with the necessary advance notice to the Infection Prevention and Control service, so that together they can provide the recommendations they consider necessary to avoid, as far as possible, the generation of environmental pollution, which includes:

- air quality.
- infection control.
- basic supplies.
- noise.
- vibration.
- dangerous materials.

The Infection Prevention and Control service categorizes the risk according to the definitions and will recommend specific measures prior to evaluating the type of construction. (Annex III).

Precautions to take into account depending on the type of construction:

GROUPS OF RISK	TYPE "A"	TYPE B"	TYPE "C"	TYPE "D"
Low	Class I	Class II	Class II	Class III/IV
Half	Class I	Class II	Class III	Class IV
High	Class I	Class II	Class III/IV	Class IV
Maximum	Class II	Class III/IV	Class III/IV	Class IV

Precautions and recommendations based on risk:

CLASS	During Construction	At the end of the construction	Controls/Audit and Responsible
Yo	- Minimize the amount of dust produced. - Replace any ceiling tiles that may be withdrawals immediately. Minimal demolition.	- Properly clean the entire area upon completion of the work.	- Control of compliance with rules per turn. - Department of Architecture.
II	- Implement work methods to minimize dust dispersion. - Use water sprays on surfaces to control suspended dust. - Seal the doors with specific adhesive tape. - Isolate the air conditioning system or ventilation system in the area where you are working. - Place a damp cloth at the entrance and exit of the work area.	- Clean all surfaces with disinfectant detergent. - Place construction waste in containers covered prior to transportation. - Clean with rag wet and/or vacuum cleaner before leaving the work area. - At the end of the cleaning, restore ventilation or air conditioning.	- Control of compliance with rules per turn. - Responsible for Department of Architecture.
III	- Obtain approval from the Infection Prevention and Control Service before starting work.	- Do not remove barriers until cleaning is complete and be	- Report with anticipation and responsible for work,

	- Complete the entire barrier system (enclosures) before starting the work (plastic and/or Durlock) to isolate the work area from the rest of the surrounding areas. - Seal all unused doors with tape. - Define access and exit points to the work. - Define alternative circulation for staff and/or patients. - If possible, use HEPA filters to maintain negative air pressure in the work area. - Spray surfaces with water during procedures that involve cuts.	inspected by personnel responsible for the project. - Remove the barriers carefully for minimize the amount of dirt and debris associated with the construction. - Clean all the surfaces with disinfectant detergent. - At the end of the cleaning, restore ventilation or air conditioning.	Infection Control Committee and the head of Section.
IV	- Obtain approval from the Infection Prevention and Control Service before starting work. - Complete the entire barrier system (enclosures) before starting the work (plastic and/or Durlock) to isolate the work area. - Isolate the air conditioning system or ventilation system in the area where you are working for prevent contamination of the ducts. - Block and seal any duct openings. - Design staff circulation if possible outside the hospital, but otherwise design an anteroom for changing. Construction personnel must wear shoe covers and change them every time they leave the work area. - Place damp cloths at the entrance and exit. - If possible, use HEPA filters to maintain negative air pressure in the work area.	- Do not remove barriers until cleaning is complete and be inspected by person responsible for the project. - Remove the barriers carefully for minimize the amount of dirt and debris associated with the construction. - Place construction waste in containers covered prior to transportation. - Clean with rag wet and/or vacuum cleaner before leaving the work area. - Clean the entire surface with Detergent disinfectant. - To the finish with the cleaning restore the ventilation either air conditioned.	- Report with anticipation and responsible for the work to the Infection Control Committee and the Head of Service. - Audit by the Infection Control Committee. - Control by he Department of Architecture.

	- Spray surfaces with water during procedures that involve cuts. - Have a complete check list to be able to complete the work.		

Steps to follow before construction and/or remodeling is carried out:

1. Notify the Infection Control Committee about the work planned to be carried out.
2. Categorize the work according to the type of activity to be carried out and risk group for patients. (Annex IV)

RISK MATRIX Check the class (I; II; III; IV) corresponding to the type of activity and level of risk				
Type of activity	**Risk to patients**			
	LOW	**HALF**	**HIGH**	**MAXIMUM**
A-Inspection and non-invasive work(without dust generation)	**Yo**	**Yo**	**II**	**III/IV**
B-Small scale and short activities duration(with little dust generation)	**II**	**II**	**III**	**III/IV**
C-Activities that require demolition or removal of fixed building structures (with generation of moderate to high level of dust)	**II**	**III**	**III/IV**	**III/IV**
D-Demolition projects and major works	**III/IV**	**III/IV**	**III/IV**	**IV**

Bibliographic references

1. Design, care processes, microbiological quality of air and water. Printed version ISSN 0716-1018Rev. Chile. Infectol. vol.36 no.2 Santiago Apr. 2019 http://dx.doi.org/10.4067/S0716-10182019000200126
2. Thio CL, Smith D, Merz WG,*et. to the*. Refinements of environmental assessment during an outbreak investigation of invasive aspergillosis in a leukemia and bone marrow transplant unit. Infect. Hosp Control Epidemiol. 2000;21:18–23. https://www.cdc.gov/infectioncontrol/guidelines/environmental/background/air.html #c4
3. Reinventing Healthcare Facility Construction and Renovation During a Pandemic Emergency Russell N. Olmsted, MPH, CIC, FAPIC Published online August 4, 2021.
4. Centers for Disease Control and Prevention (CDC) Guidelines for Environmental Infection Control in Healthcare Facilities: Recommendations from CDC and the Advisory Committee on Healthcare Infection Control Practices (HICPAC) MMWR 2003; 52 (No.RR-10):1–48.
5. https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html Available at: Accessed February 1, 2021. [PubMed] [Google Scholar]
6. Epidemiology of Weinstein's RA and control of nosocomial infections in adult intensive care units. Am J Med. 1991; 91 (Suppl 3B):179S–184S. [PubMed] [Google Scholar]
7. Weber DJ, Rutala WA Understand and prevent the transmission of healthcare-associated pathogens due to the contaminated hospital environment. Hosp Epidemiol Infection Control. 2013; 34:449–452. [PubMed] [Google Scholar]
8. American Heating Society. ASHRAE; Atlanta (GA): 2021. Air Conditioning and Refrigeration Engineers (ASHRAE), Healthcare Facility Ventilation. ANSI/ASHRAE/ASHE Standard 170-2021. [Google actresses]
9. Facilities Guidelines Institute (FGI). Guidelines for the Design and Construction of Hospitals, 2018. FGI. https://fgiguidelines.org/guidelines/purchasethe-guidelines/ Available at: Accessed December 29, 2020.
10. Burmahl B., Morgan J. 2020 Hospital Construction Survey. Advanced planning, design and construction technology helps drive the efficiency of construction projects. Management of Health Facilities, ASHE. 03/19/2020. https://www.hfmmagazine.com/articles/3859-hospital-construction-survey Available at: Accessed February 22, 2021.
11. Fernando Moreno, et al, Recommendations for the prevention of infections related to demolitions, constructions and remodeling Unit for the Prevention and Control of Infections Associated with Health Care. Carlos van Buren Hospital of Valparaíso APPROVED: May 17, 2015
12. http://silicecrystalline. lineaprevencion.com/ or the guide http://www.

lineaprevencion.com/uploads/proyecto/applications/ARCH5cadcec604731.pdf for more information).
13. http://nanomateriales.lineaprevencion. com/nanomateriales or the manual http://www.lineaprevencion.com/uploads/proyecto/applications/ARCH5cc033c60f8c3.pdf.
14. Fernando Moreno*et. to the.*, Ankie Schade. Recommendations for the prevention of infections related to demolitions, construction and remodeling. Medicine and Health Magazine. Bol. Micol. 2015; 30(1): 34 - 37
15. Guide to Dust Measurement and Preventive Measures in Construction. https://www.lineaprevencion.com/servicios/proyectos/guia-de-medicion-del-polvo-ymedidas-preventivas-en-obras-de-construccion.

ANNEX I:**Dust classification**

Silica powder: Silica is a natural mineral present in large quantities in materials such as sand, sandstone and granite. It is also commonly found in many construction materials, such as concrete and mortar. Silica breaks down into very fine dust (also known as respirable crystalline silica or SCR) during several common tasks such as cutting, drilling and grinding. It is often called silica powder.

Silica-free powder: There are a number of construction products where silica is not found or is present in very low quantities. The most common include gypsum, limestone, marble and dolomite. This powder is also mixed with silica powder when cutting other items such as bricks.

Wood dust: Wood is widely used in construction and is found in two main forms; soft and hard wood. Wood-based products are also commonly used, including MDF (low-density, wood-derived fiberboard) and chipboard.

Nanomaterials: These particles can be added to the product (concrete to which nano-silica is added, or cements to change its characteristics) and generated during the processes (cutting, sanding, etc.), the problem is that they are not usually described in the product labels or safety data sheets.

Metal powders:particles originating from the condensation of metal fumes that are generated in processes with high temperatures such as welding.

ANNEX II:**Work permit**

PERMISO Nº	Fecha de inicio del proyecto:	Fecha en que expira el permiso:	Duración estimada:	Horarios de Trabajo
17-0001				De …. ….hs A …. ….hs

Sector donde se realizará la construcción:

ÁREAS ADYACENTES	Abajo	Arriba	Lateral	Lateral	Adelante	Atrás
Unidad/Sector						
Nivel de Riesgo						

Director del proyecto:	**Teléfono de contacto:**
Supervisor:	**Teléfono de contacto:**
Contratista:	**Teléfono de contacto:**

MATRIZ DE RIESGO Tildar la clase (I; II; III; IV) correspondiente al tipo de actividad y nivel de riesgo

Tipo de Actividad	Riesgo para los pacientes			
	BAJO	MEDIO	ALTO	MÁXIMO
A-Inspección y trabajos no invasivos (sin generación de polvo)	I ☐	I ☐	II ☐	III /IV ☐
B-Actividades de pequeña escala y corta duración (con escasa generación de polvo)	II ☐	II ☐	III ☐	III /IV ☐
C-Actividades que requieren demolición o remoción de estructuras edilicias fijas (con generación de moderado a alto nivel de polvo)	II ☐	III ☐	III/IV ☐	III/IV ☐
D-Proyectos de demolición y grandes obras	III/IV ☐	III/IV ☐	III/IV ☐	IV ☐

CLASE	Durante la etapa de construcción
I ☐	1-Ejecutar el trabajo a través de métodos que generen la mínima cantidad de polvo. 2-Cerrar inmediatamente los cielorrasos abiertos para inspección, minimizando el tiempo de apertura al mínimo posible
II ☐	1-Ejecutar el trabajo a través de métodos que generen la mínima cantidad de polvo. 2-De ser posible, rociar con agua las superficies durante los procedimientos que involucren cortes. 3-Bloquear y sellar las toma de aire. 4-Aislar los sistemas de ventilación en áreas involucradas para prevenir la contaminación de los conductos. 5-Sellar con cinta toda puerta que no se utilice. 6-Colocar los escombros / residuos de obra en contenedores cubiertos y sellados antes de ser removidos del lugar. 7-Colocar alfombra adhesiva y/o trapo húmedo en las zonas de accesos o salida para la limpieza del calzado.
III ☐	1-Obtener aprobación del Servicio de Prevención y Control de Infecciones antes de comenzar la obra. 2-Completar todo el sistema de barreras (cerramientos) antes de comenzar con la obra (plásticos y/o durlock) para aislar el área de trabajo del resto de las áreas circundantes. 3-Sellar con cinta toda puerta que no se utilice. 4-Bloquear y sellar las toma de aire. 5-Aislar los sistemas de ventilación en áreas involucradas para prevenir la contaminación de los conductos. 6-Definir los puntos de acceso y salida a la obra. 7-Definir la circulación alternativa para el personal y/o pacientes. 8-Mantener presión negativa de aire en el área de obra mediante equipos de filtración utilizando en lo posible filtros HEPA. 9-De ser posible, rociar con agua las superficies durante los procedimientos que involucren cortes. 10-Colocar los escombros / residuos de obra en contenedores cubiertos y sellados antes de ser removidos del lugar. 11-Colocar alfombra adhesiva y/o trapo húmedo en los accesos o salida para la limpieza del calzado.
IV ☐	1-Obtener aprobación del Servicio de Prevención y Control de Infecciones antes de comenzar la obra. 2-Completar todo el sistema de barreras (cerramientos) antes de comenzar con la obra (plásticos y/o durlock) para aislar el área de trabajo del resto de las áreas circundantes. 3-Colocar una puerta de acceso. 4-Sellar con cinta toda puerta que no se utilice. 5-Bloquear y sellar apropiadamente las toma de aire, huecos, conductos y caños. 6-Aislar los sistemas de ventilación en áreas involucradas para prevenir la contaminación de los conductos. 7-Definir el punto de acceso y salida a la obra. 8-Construir una antesala para que el personal de obra acceda a la misma a través de dicho sector, debiendo vestir mameluco descartable sobre la ropa de trabajo que será desechado al salir de la antesala o bien ser sometido a aspiración con aspiradora con filtro HEPA. 9-Definir la circulación alternativa para el personal y/o pacientes. 10-Mantener presión negativa de aire en el área de obra mediante equipos de filtración utilizando en lo posible filtros HEPA. 11-Toda persona que ingrese al sector deberá utilizar protector de calzado el cual deberá ser desechado al dejar el sector. 12-De ser posible, rociar con agua las superficies durante los procedimientos que involucren cortes. 13-Colocar los escombros / residuos de obra en contenedores cubiertos y sellados antes de ser removidos del lugar. 14-Colocar alfombra adhesiva y/o trapo húmedo en los accesos o salida para la limpieza del calzado.

Conformidad de requerimientos	Presentación de Documentación (SySO)			Sellado, Cerco de Obra y señalización			Corte de Ventilación			Contención del polvo al ingreso			Bloqueo de detección de incendios			Garantizada la circulación junto al cerco (camillas)			Extracción forzada para polvo y humos		
	SI	NO	N/A	SI	NO	N/A	SI	NO	N/A	SI	NO	N/A	SI	NO	N/A	SI	NO	N/A	SI	NO	N/A

Solicita el permiso:	**Autoriza el permiso: SySo**	**Autoriza el permiso: Control de infecciones**
Firma: **Fecha:00-00-00**	**Firma:** **Fecha:00-00-00**	**Firma:** **Fecha:00-00-00**

ANNEX III:**General recommendations for infection risk control**

- If construction and demolition tasks are carried out outdoors, access to the unit from outside air must be sealed or, failing that, if this is not possible, check the filters frequently to verify that they are correctly placed so that they do not allow the entry of outside air, that they do not become saturated and that they are replaced whenever necessary.
- The hospitalization and care areas for transplanted and immunosuppressed patients must be protected when carrying out fire and emergency drill tasks, for example: by placing weather stripping around the doors that lead to the stairs or filtering the air coming from the stairs. adjacent stairs.

- Whenever possible, the existence of false ceilings should be avoided. If this is not possible, they should be routinely vacuumed (vacuum cleaners with HEPA filters) to minimize dust and patients' exposure to environmental germs.
- During construction or renovation, rigid, dust-proof, airtight barriers must be placed between patient care areas and the area affected by construction or renovation tasks. These barriers (for example: sealed drywall, false walls), must be impermeable to spores of *Aspergillus*sp. If impermeable barriers cannot be created throughout the construction area, patients should be moved from those areas until construction and renovation work is completed and until the care area has been adequately cleaned.

- Staff and visitor traffic that normally occurs near construction or renovation areas should be redirected away from patient care areas.

- Limit the opening and closing of doors that may cause dust dispersion or allow contaminated air to enter from adjacent areas.
- Specific and exclusive access routes must be created for the use of personnel working in construction and/or renovation, such as corridors, hallways, elevators, entrances, exits and even bathrooms (sanitary rooms).
- For the removal of debris and the circulation of personnel carrying out masonry tasks, the use of an exclusive elevator must be reserved, and the circulation areas to which patients will not have access must be marked. The reason why construction workers must have specific circulation areas, with a dedicated elevator for everything related to construction and renovation and avoid contact with patients, patient care areas, elevators and other areas of hospitalization not involved with the construction work, is also related to the fact that their clothing could be contaminated with fungal spores.

- Place sticky floor mats (special mats that trap dust from footwear) at the threshold of construction areas to minimize the spread of dust.

- Small, visible dust and debris should be removed by vacuuming with vacuum cleaners with HEPA filters located in the vacuum exhaust zone. Failing this, dust should be collected continuously using wet methods and damp cloths should be placed at the exit of the rooms where repairs are being carried out.
- Debris should be removed covered with wet sheets, to avoid the dispersion of dust into the hospital environment.
- Carry out visual inspection of the presence of environmental dust through active surveillance of infections associated with constructions.

ANNEX IV:**Work survey sheet**

Control of construction and/or remodeling works										
Work start date:			Estimated time of the work:				Service/area/sector:			
Classification of the work:			Estimated time construction site:				Material used for containment:			
Evaluator:					Responsible for the work:					
Enter Yes or No, as appropriate:										
work day	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Material of containment correct										
Sealed correct										
powder in adjacencies										
Leaks from liquids										
Leaks from gases										

INE-SADI-ADECI Interinstitutional Consensus 2023-"SAFE HOSPITAL"

ISBN 978-987-48850-5-0