

Desarrollo de sistemas de evaluación sobre respiradores de protección personal N95 y su aplicación en sistemas locales de Descontaminación por UV-C

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Departamento de innovación tecnológica Instituto de Cardiología de Corrientes



Conflictos de interés

Apoyo y Soporte

Gobierno de la provincia de Corrientes

Ministerio de ciencia y técnica de la Provincia de Corrientes

Fundación Cardiológica de Corrientes

Instituto de Cardiología de Corrientes

Gobierno Nación Argentina

Ministerio de Ciencia y Técnica de la Nación



INTRODUCCION y Contexto Covid-19

Enfermedad declarada pandemia MARZO 2020

Provocada por coronavirus SARS-Cov-2.

Inicialmente 5% de mortalidad

Síntomas principalmente respiratorios,

Altamente contagiosa de paciente a paciente por las gotitas de Fluge.

MUNDO Hoy lleva: >7.000.000 muertes (>700 millones de infectados confirmados y 2mil millones sospechosos)

5 a 13 mil millones de vacunados

EL PERSONAL DE SALUD ES FRANCAMENTE MAS VULNERABLE de 3 a 11 VECES mas vulnerable

*Nguyen LH, Drew DA, Graham MS, Joshi AD, Guo CG, Ma W, Mehta RS, Warner ET, Sikavi DR, Lo CH, Kwon S, Song M, Mucci LA, Stampfer MJ, Willett WC, Eliassen AH, Hart JE, Chavarro JE, Rich-Edwards JW, Davies R, Capdevila J, Lee KA, Lochlainn MN, Varsavsky T, Sudre CH, Cardoso MJ, Wolf J, Spector TD, Ourselin S, Steves CJ, Chan AT; COronavirus Pandemic Epidemiology Consortium. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. Lancet Public Health. 2020 Sep;5(9):e475-e483. doi: 10.1016/S2468-2667(20)30164-X. Epub 2020 Jul 31. PMID: 32745512; PMCID: PMC7491202.

**MMWR / September 25, 2020 / Vol. 69 / No. 38 US Department of Health and Human Services/Centers for Disease Control and Prevention

***Informe Diario - Ministerio de Salud de la Nación. 20/05/2020



Barreras de protección

Barbijos N95 (certificados NIOSH)

- ▶ Rápidamente se convirtieron en un bien escaso, caro, y difícil de conseguir
- ▶ Alto Costo inicial
- ▶ Importados

INSUFICIENTES



Nuestro País Inicialmente (2020)

Usamos los N95 durante varios días. El Ministerio de Salud indicó que deben utilizarse durante:

- ▶ Hasta 15 días en jornadas de trabajo menores a 7 horas diarias
- ▶ Hasta 7 días en jornadas mayores a 7 horas diarias

Riesgo

- 1) La superficie externa de un N95 puede contaminarse conteniendo SARS-CoV-2
- 2) Los SARS-CoV-2 de las superficies externas pueden transferirse al usuario por ponérselo o quitárselo manera incorrecta.
- 3) El riesgo aumenta con la cantidad de veces de re-uso aun en jornada reducida

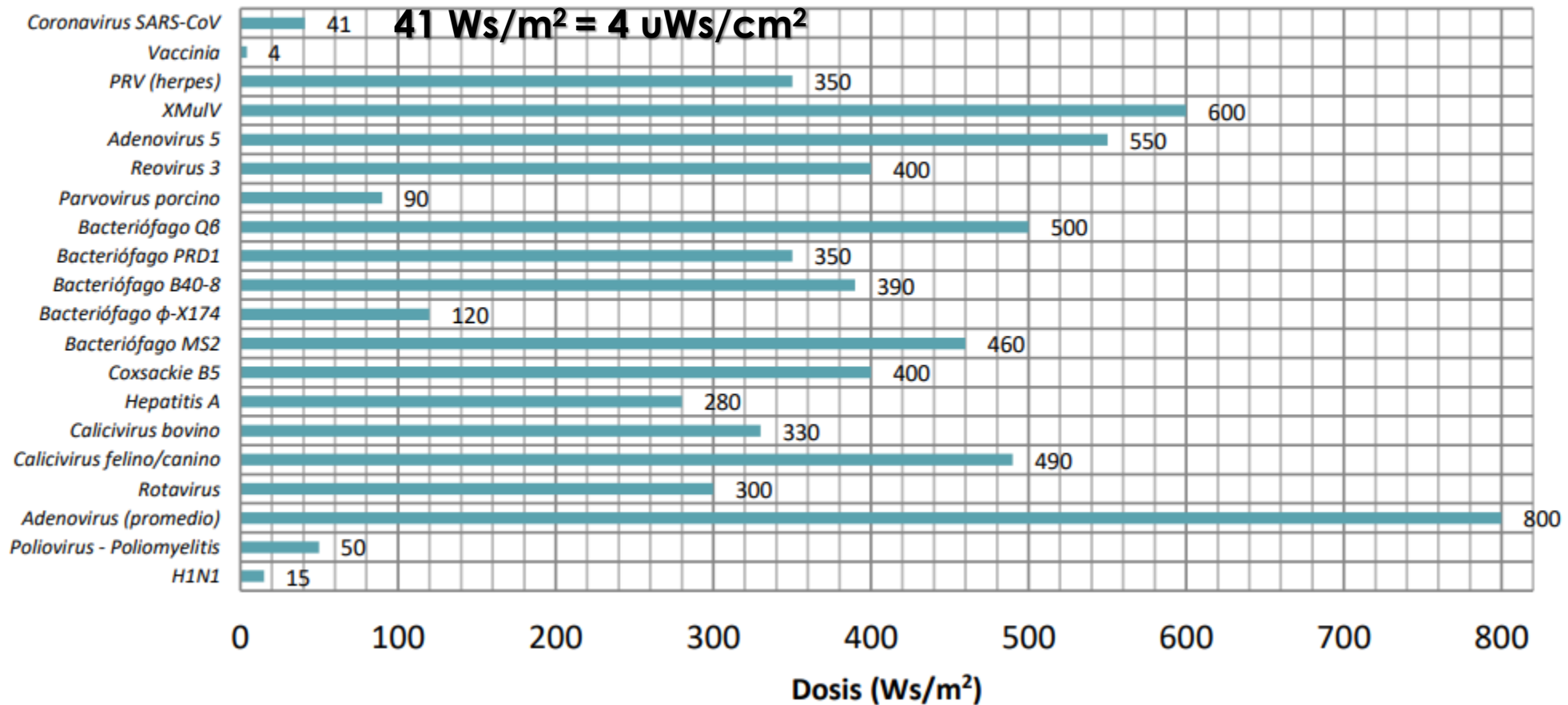


Sistemas de descontaminación y ReUso de N95

- ▶ Peróxido de hidrógeno (FDA desde marzo 2020)
 - ▶ Como Vapor
 - ▶ Como Gas
- ▶ Ox. Etileno (no recomendado por desgaseado)
- ▶ Radiación Gamma Co60 (no recomendado por afectar la capacidad de filtrado)
- ▶ Autoclave (no recomendado por afectar la capacidad de filtrado)
- ▶ Soluciones tensioactivas ALCOHOL (no recomendado)
- ▶ **RADIACION ULTRAVIOLETA TIPO C (PROMETEDORA CDC)**



Dosis requeridas para inactivación de virus (4 log)

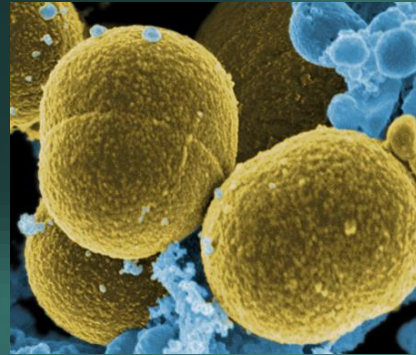


Artículo de revisión: estudio de la radiación UV-C como método de desinfección de ambientes y superficies con enfoque en la prevención del contagio de COVID-19 Ing. María Sabrina Lecam



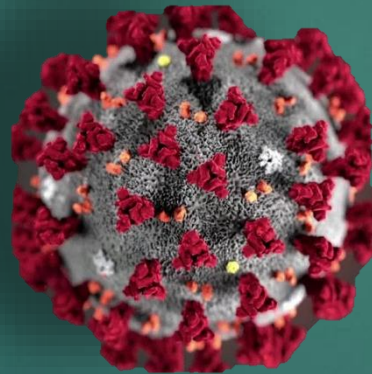
Stafilococo vs Coronavirus

Stafilococo



410 uWs/cm² *

SARS-CoV-2



2 a 5 ** uWs/cm² ***

* Ontiveros CC et al. Characterization of a commercially-available, lowpressure UV lamp as a disinfection system for decontamination of common nosocomial pathogens on N95 filtering facepiece respirator (FFR) material. *Environ. Sci.: Water Res. Technol.*, 2020, 6, 2089

** Chun-Chieh Tseng & Chih-Shan Li (2007) Inactivation of Viruses on Surfaces by Ultraviolet Germicidal Irradiation, *Journal of Occupational and Environmental Hygiene*, 4:6, 400-405

*** Jureka, A.S.; Williams, C.G.; Basler, C.F. Pulsed Broad-Spectrum UV Light Effectively Inactivates SARS-CoV-2 on Multiple Surfaces and N95 Material. *Viruses* 2021, 13, 460



EFFECTO GERMICIDA DEL UV-C PROBADO



2004
Available online at www.sciencedirect.com
SCIENCE @ DIRECT®
Journal of Virological Methods 121 (2004) 83–91

Inactivation of the coronavirus that induces severe acute respiratory syndrome, SARS-CoV

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Available online 3 August 2004

Abstract

Severe acute respiratory syndrome (SARS) is a life-threatening disease caused by a novel coronavirus. The World Health Organization (WHO) recommends that manipulation of active coronavirus laboratories at biosafety level 3 (BSL-3). The virus was inactivated by ultraviolet C (UV-C) at 12 or 120 mJ/cm² or acetic (pH < 3) conditions. Formalin and glutaraldehyde treatment inactivation methods, which will allow research with SARS-CoV containing materials, at reduced safety levels.

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Keywords: SARS; Coronavirus; Virus inactivation; Tissue culture

1. Introduction

In late 2002, an outbreak of unusual life-threatening respiratory disease of unknown etiology began in Guangdong Province, China. This disease was designated severe acute respiratory syndrome (SARS) and was later determined by Drosten et al. (2003), Kuznetsov et al. (2003), and Rota et al. (2003), to be caused by a novel coronavirus, termed SARS-CoV. Since the identification of coronavirus as the infectious agent for SARS, numerous laboratories have begun research on this virus. According to the WHO, 8098 people were diagnosed with SARS and 774 people died of this disease during the initial outbreak of 2003. Due to the severity of SARS disease and the contagious nature of the causal agent, the WHO website (http://www.who.int/csr/sars/biosafety2003_12_16/en/) has provided guidelines for working safely with this coronavirus. The WHO recommends biosafety level 3 (BSL-3) as the appropriate containment level for working with live

SARS-CoV, and that break could occur readily. Since these have been the researchers due to 2004). Successful for of material from reduce the risk of ratory practices. It may also be useful study of their safe efficiency of severe methods that may

2. Materials and

2.1. Virus and cell

We infected A cells with SARS-CoV provided by Drs. L.

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E-mail address: stephen.feinstone@hhs.gov (S.M. Feinstone).

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doi:10.1016/j.jviro.2004.06.006



Moore et al. BMC Infectious Diseases 2012, 12:174
<http://www.biomedcentral.com/1471-2334/12/174>

2012



RESEARCH ARTICLE

Open Access

Use of UV-C radiation to disinfect non-critical patient care items: a laboratory assessment of the Nanoclave Cabinet

Ginny Moore^{1*}, Shamim Ali^{1,4}, Elaine A. Cloutman-Green², Christina R. Bradley³, Martyn AC Wilkinson³, John C. Hartley², Adam P. Frazer² and A. Peter R. Wilson¹

Abstract

Background: The near patient environment is often heavily contaminated, yet the decontamination of near patient surfaces and equipment is often poor. The Nanoclave Cabinet produces large amounts of ultraviolet-C (UV-C) radiation (53 W/m²) and is designed to rapidly disinfect individual items of clinical equipment. Controlled laboratory studies were conducted to assess its ability to eradicate a range of potential pathogens including *Clostridium difficile* spores and Adenovirus from different types of surface.

Methods: Each test surface was inoculated with known levels of vegetative bacteria (10^6 cfu/cm²), *C. difficile* spores (10^7 – 10^8 cfu/cm²) or Adenovirus (10^7 viral genomes), placed in the Nanoclave Cabinet and exposed for up to 6 minutes to the UV-C light source. Survival of bacterial contaminants was determined via conventional cultivation techniques. Degradation of viral DNA was determined via PCR. Results were compared to the number of colonies or level of DNA recovered from non-exposed control surfaces. Experiments were repeated to incorporate organic soils and to compare the efficacy of the Nanoclave Cabinet to that of antimicrobial wipes.

Results: After exposing 8 common non-critical patient care items to two 30-second UV-C irradiation cycles, bacterial numbers on 40 of 51 target sites were consistently reduced to below detectable levels (≥ 4.7 log₁₀ reduction). Bacterial load was reduced but still persisted on other sites. Objects that proved difficult to disinfect using the Nanoclave Cabinet (e.g. blood pressure cuff) were also difficult to disinfect using antimicrobial wipes. The efficacy of the Nanoclave Cabinet was not affected by the presence of organic soils. *Clostridium difficile* spores were more resistant to UV-C irradiation than vegetative bacteria. However, two 60-second irradiation cycles were sufficient to reduce the number of surface-associated spores from 10^7 cfu/cm² to below detectable levels. A 3 log₁₀ reduction in detectable Adenovirus DNA was achieved within 3 minutes; after 6 minutes, viral DNA was undetectable.

Conclusions: The results of this study suggest that the Nanoclave Cabinet can provide rapid and effective disinfection of some patient related equipment. However, laboratory studies do not necessarily replicate 'in-use' conditions and further tests are required to assess the usability, acceptability and relative performance of the Nanoclave Cabinet when used in situ.

Keywords: Ultraviolet radiation, Surface disinfection, Nosocomial pathogens, Adenovirus

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pj Clean Water

NATURE

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ARTICLE OPEN

Impact of UV irradiation at full scale on bacterial community in drinking water

Ujan Palit^{1,2}, Jon Ahlin³, Linda Holmér⁴, Ernest Salomonsson⁵, Caroline Öhrman⁶, Karin Jacobsson^{6,7}, Mikael Drystell^{1,8}, Catherine J. Field^{9,10} and Peter Rådström¹

Water in a full scale drinking water treatment plant was irradiated with ultraviolet (UV) doses of 250, 400, and 600 J/m², and the effect on bacterial communities investigated using 16S rRNA gene amplicon sequencing, heterotrophic plate counts (HPCs), coliform, and *Escherichia coli* counts. The bacteria in the irradiated water were also analyzed following storage for 6 days at 7 °C, approximate the conditions in the distribution system. The log₁₀ reduction of HPCs at 400 J/m² was 0.43 ± 0.12. Phylogenetic examination, including DGEseq analysis, showed that Actinobacteria was more resistant to UV irradiation, whereas Bacteroidetes was sensitive to UV. Phylum Proteobacteria contained monophyletic groups that were either sensitive or resistant to UV exposure. Ten amplicon sequence variants (ASVs) resistant to UV irradiation had a greater average GC content than the ASVs sensitive to UV, 55% ± 1.7 (n = 19) and 49% ± 2.5 (n = 16), respectively. Families Oribacteriales, Polybacteraceae, Halobacteraceae, Methylophilaceae, and Cytophagaceae decreased linearly in relative abundance, with increasing UV dose (P < 0.05, Pearson's correlation). When irradiated water was stored, Oribacteriales, Gemmatimonadetes, and Flavobacteriaceae families decreased relative abundance, whereas Actinobacteria, Mycobacteriaceae, and Nitrospirales were increasing in relative abundance. This suggests that the impact of UV irradiation cannot only be considered directly after application but that this treatment step like continues to influence microbial dynamics throughout the distribution system.

npj Clean Water (2020) 3:11; <https://doi.org/10.1038/s41545-020-0057-7>

INTRODUCTION

Ultraviolet (UV) irradiation is widely used as a disinfection method for drinking water treatment. The technique became biosociologically solar in the 1990s when its ability to disinfect water containing sporozooids and Giardia was recognized¹. Unlike other disinfection methods such as chlorination or ozonation, UV disinfection requires no addition of chemicals and low pressure products. Significant amounts of disinfection byproducts^{2,3} in water have different UV susceptibility, a 4–log₁₀ reduction of a lab-grown environmental isolate of *Mycobacterium avium* requires a dose of 128 J/m² UV 254 nm⁴, whereas for the reduction of cultivated environmental isolate of *Escherichia coli* requires a dose of 81 J/m². The dose required for disinfection can be affected by suspended particles in the water, which can absorb and scatter UV light and affect UV efficiency^{5,6}.

The disinfection mechanism resulting from exposure to UV is DNA damage to nucleic acids by irradiation⁷. Nucleotides absorb light with wavelengths of between 200 and 300 nm with a k absorption between 260 and 265 nm⁸. The absorption of light triggers the formation of mutagenic DNA lesions, such as thymine pyrimidine dimers and 6–4 photoproducts⁹. Both lesions and purines can absorb UV light, although purines are considered to be more photoreactive^{10,11}. When nucleotides are damaged by UV light, the DNA replication is blocked, resulting in cell inactivation^{12,13}. Some microorganisms are able to repair UV damage either by photoreactivation or dark repair^{14,15}.

The impact of UV on target microorganisms has largely studied using cultivation-based techniques of monoculture laboratory scale¹⁶. At full scale, a bioassay test is used to calibrate the irradiation dose for UV reactors by spiking a concentration of a specific cultured microorganism and calculating the log reduction. This is compared with results from calibrated laboratory UV reactor to calculate the final UV dose at the full-scale UV reactor at a specific UV transmission and flow. The validity of these tests to assess disinfection of drinking water, however, is debatable, as the majority of microorganism in drinking water cannot currently be cultivated¹⁷; bacter drinking water are diverse, and bacteria in the environment an increased UV resistance compared with laboratory culture strains¹⁸. Exposure to UV can also cause some bacteria to be viable but nonculturable state as a response to environment stress^{19,20}.

Molecular DNA based methods analyze the microbial community without the need for cultivation and, as UV irradiation of DNA lesions and reduces the number of amplifiable templates in the PCR reaction^{21,22}, amplicon based methods describe which types of bacteria and genes are affected by UV. Microbial inactivation of *Pseudomonas aeruginosa* and *Enterococcus faecalis* by UV was assessed by cultivation and quantitative (qPCR)²³ and impact of UV on adenovirus concentrations measured by cell culture infectivity and long range PCR subsequent qPCR²⁴. The impact of UV irradiation on the rRNA bacteria in drinking water has been quantified with 16S rDNA amplification²⁵.

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Cleveland clinic

UV Sterilization of Personal Protective Equipment with Idle Laboratory Biosafety Cabinets During the COVID-19 Pandemic.

Theory Division^{1,2,3,4,5,6,7}

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⁴Authors in alphabetical order: Kyle J. Card, Dena Crozier, Andrew Dhawan, Mina Dinh, Emily Dolson, Nathan Farrokhan, Vishwvwan Gopalkrishnan, Emily Ho, Eshan S. King, Nikhil Krishnan, Gieb Kuzmin, Jeff Maltas, Julia Polosko, Jossica A. Scapellato, Jacob G. Scott, Geoff Sador, Davis T. Weaver

ABSTRACT

DISCLAIMER: This article does not represent the official recommendation of the Cleveland Clinic or Case Western Reserve University School of Medicine, nor has it yet been peer reviewed. We are releasing it early, pre-peer review, to allow for quick dissemination/vetting by the scientific/clinical community given the necessity for rapid conservation of personal protective equipment (PPE) during this dire global situation. We welcome feedback from the community.

Personal protective equipment (PPE), including surgical masks and N95 respirators, is crucially important to the safety of both patients and medical personnel, particularly in the event of infectious pandemics. As the incidence of Coronavirus Disease (COVID-19) is increasing exponentially in the United States and worldwide, healthcare provider demand for these necessities is currently outpacing supply. As such, strategies to safely expand the lifespan of the supply of medical equipment are critically important. In the recent days, weeks, and months, in the midst of the current pandemic, there has been a concerted effort to identify viable ways to conserve Personal Protective Equipment, including sterilization after use. Some hospitals have already begun using UV-C light to sterilize N95 respirators, but many lack the space or equipment to implement existing protocols. In this study, we outline a procedure by which N95 respirators may be sterilized using ultraviolet (UV) radiation in biosafety cabinets (BSCs), a common element of many academic, public health, and hospital laboratories. The primary obstacle to this approach is the possibility the UV radiation levels vary within BSCs. To account for this potential variation in dosing across the base of the BSC, we tested the UV-C radiation in two randomly chosen idle BSCs in our research institute and observed a maximum ratio between the minimum and maximum recorded intensities within a given BSC to be 1.98. Based on these values, we calculated that an N95 mask placed within a BSC with a manufacturer's reported fluence of 100 μJ/cm² should be effectively sanitized for reuse after approximately 15–20 minutes per side. Our results provide support to healthcare organizations looking for alternative methods to extend their reserves of PPE. It is our hope that with an easily implemented strategy, as we have presented here, idle BSCs can be utilized to alleviate the PPE shortage by providing a way to sterilize PPE to allow safe daily re-use. This should be tested on a larger scale, and confirmed in a virology laboratory before adoption, though we contend that in extremis, this method would be preferred compared to re-use without sterilization.

Introduction

Personal protective equipment (PPE) is essential for protecting medical personnel and patients during the outbreak of airborne or droplet borne infectious diseases. In particular, the use of surgical masks and N95 respirators is



Proyecto

- ▶ DISEÑO
- ▶ FINANCIAMIENTO
- ▶ MATERIALIZACION

ETAPA 1

DISEÑO DE LA LAMPARA

ETAPA 2

**DEMOSTRACION LA CAPACIDAD DE
DESCONTAMINACION**

ETAPA 3

**DEMOSTRACION DE LA AUSENCIA DE
DEFORMACION**

ETAPA 4

**DEMOSTRACION DE LA INDEMNIDAD DE LA
FILTRACION**



ETAPA 1

DISEÑO DE LA LAMPARA

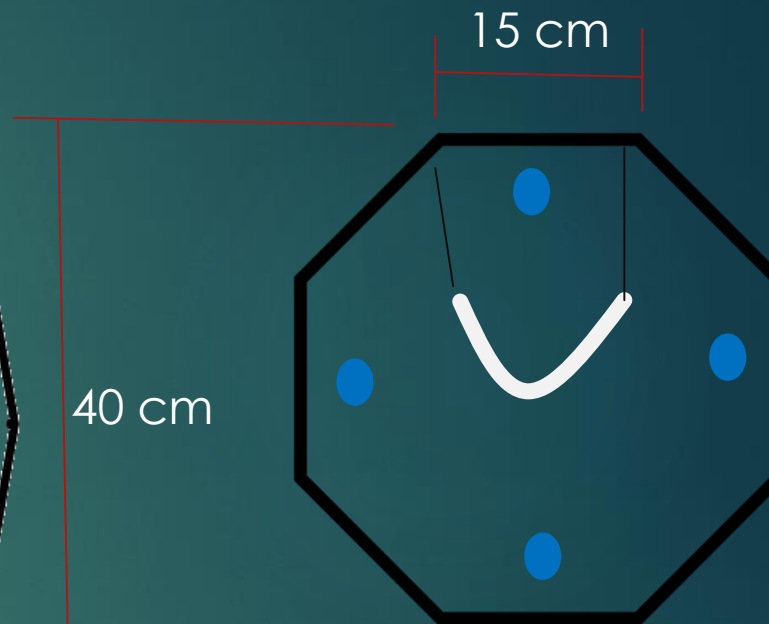
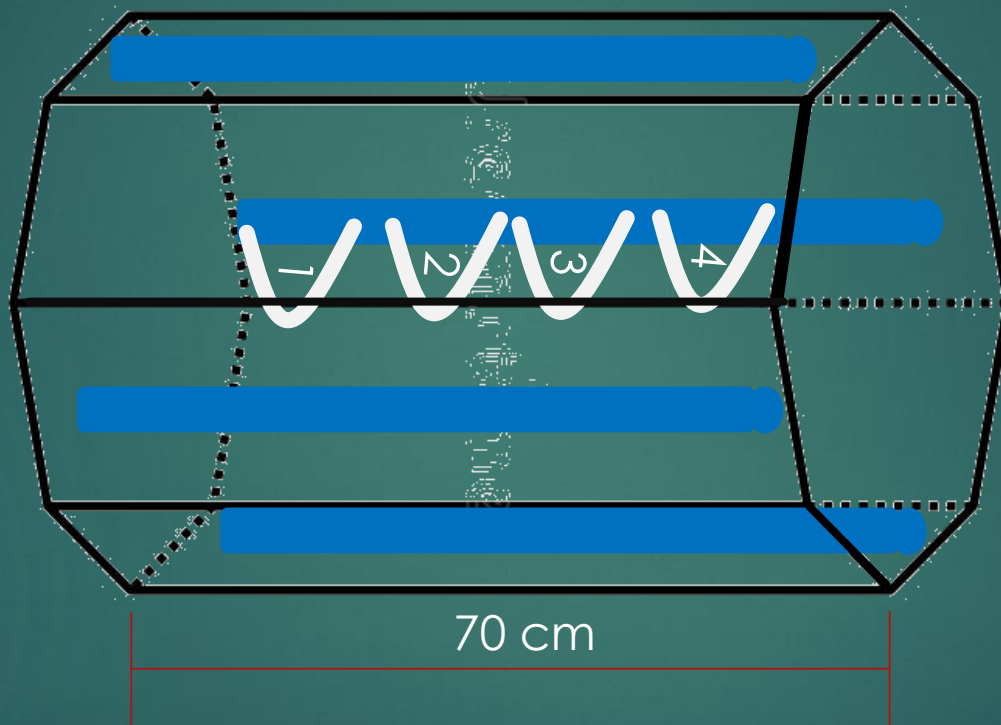
4 Tubo Germicida 20w 60
Cm T8 G13 Uv-c Alic
254nm ®

4 Balastos Electrónicos 15-
30wx2 tubogermicida-uv-
prontoluz-nacional ®

Total consumo 80W

Atenuación aproximada
UVC 50% a 1m por el aire

Generación de Ozono
calculado mínimo NS



5,3 uWs/cm² (30 seg a 3,7 min) *

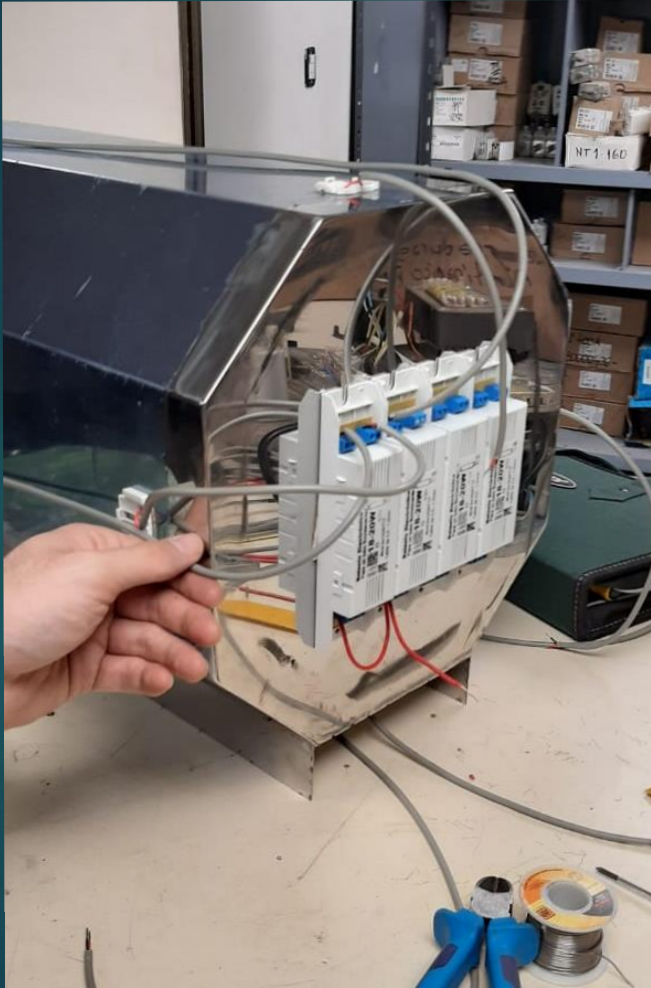
4000 uW/cm² (40 seg a 6min) **

*Moore et al. BMC **Infectious** Diseases 2012, 12:174

**Darmell M et al Journal of Virological Methods (2004) 85-91



ETAPA 1



DISEÑO DE LA LAMPARA



RG Instrumets @ $\mu\text{W}/\text{cm}^2$



- Fácil de construir
- Piezas fáciles de conseguir
- Insumos económicos
- Fácil de estivar
- Fácil manipular
- Sin riesgos durante el funcionamiento



N95 Filtering Facepiece Respirator Ultraviolet Germicidal Irradiation (UVGI) Process for Decontamination and Reuse
John J Lowe, Katie D Paladino, Jerald D Farke, Kathleen Boulter, Kelly Cawcutt, Mark Emodi, Shawn Gibbs, Richard Hankins, Lauren Hinkle, Terry Micheels, Shelly Schwedhelm, Angela Vasa, Michael Wadman, Suzanne Watson, and Mark E Rupp



Mediciones del gabinete de lámparas UVC



Ubicación		Radiación UVC ($\mu\text{W}/\text{cm}^2$)					prom
		Medición 1 H	Medición 2 V	Medición 3 H	Medición 4 V	Medición 5 D	
15 cm*	Posición 1	269	247	223	253	281	254,6
28 cm*	Posición 2	352	347	367	360	273	339,8
42 cm*	Posición 3	318	238	303	324	320	300,6
54 cm*	Posición 4	329	277	347	315	339	321,4

Tiempo (s)	Temp ($^{\circ}\text{C}$)
0	23,2
30	23,4
60	23,7
120	24,7
300	29,2

**320 $\mu\text{W}/\text{cm}^2$
SD \pm 35 CV11%**

H

V

D



ETAPA 2

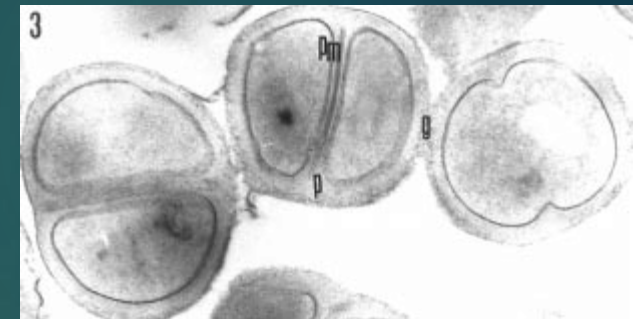
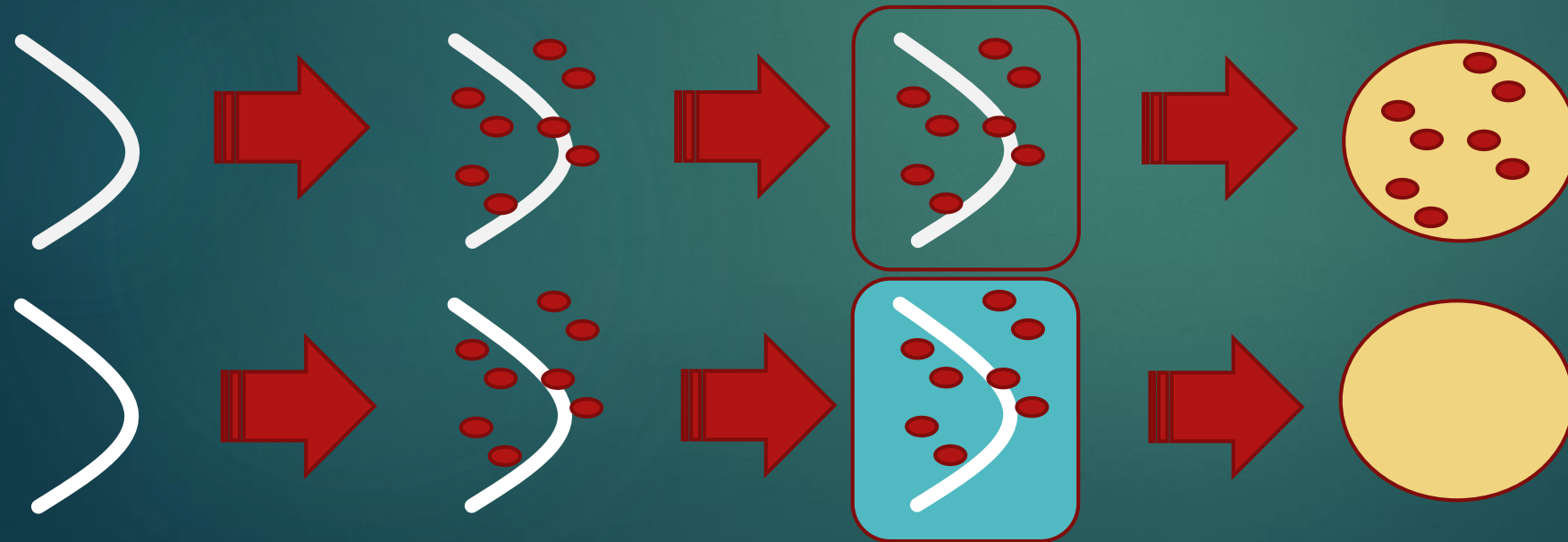
DEMOSTRACION LA CAPACIDAD DE DESCONTAMINACION



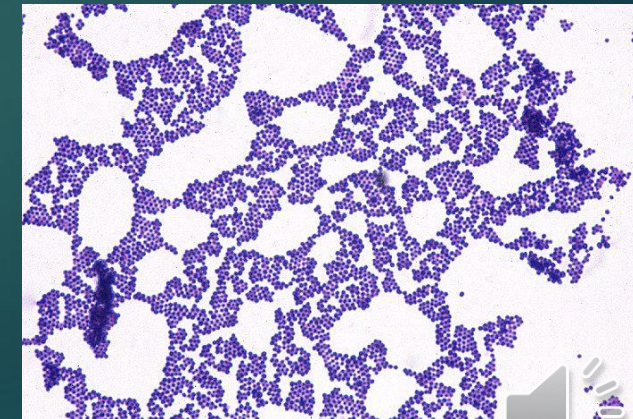
Dr Gabriel Gutkind selecciona la cepa de gérmenes apropiados

“Stafilococo Aureus ATCC 6538 P”

Dr Luis Merino evalúa Los barbijos en forma Ciega (susp 10 uL con 10^6 UFC o PFU en un 8% de moco simulado)



Staphylococcus aureus ATCC 6538 P



Sistemática de la prueba

1. Se designa los lugares en la lámpara como 1, 2 , 3, 4
2. Se entregan los barbijos al Dr Merino quien instila los gérmenes SA ATCC 6538
3. El Dr Merino devuelve en un contenedor cerrado los barbijos
4. Con guantes estériles se posicionan los barbijos en la lámpara
5. Se nombran las bolsas herméticas A, B, C, D, E etc, y asignan los tiempos a exponer a cada barbijo. Uno de ellos no se expondrá a la UVC.
6. Se realiza la exposición de la UVC con tiempos y localizaciones diferentes
7. Se retiran de la lámpara y ubican en la bolsa correspondiente
8. Se cultivan 24 hs y observan los resultados



ETAPA 2

DEMOSTRACION LA CAPACIDAD DE DESCONTAMINACION

Fecha	modelo de barbijo	tiempo minino de exposición	Adentro	Afuera
23/7/2020	ferreteria	30 min	adentro	
28/7/2020	ferreteria	5 min		Afuera
31/7/2020	Quirurgico de 3 capas	10 min	adentro	
4/8/2020	N95 3m 1860	3,5 min	adentro	
15/10/2020	N95 3m 1860	5 min		
15/10/2020	N95 3m 1860	5 min		
21/10/2020	N95 3m 9010	0,5 min		
21/10/2020	N95 3m 9010	5 min		
4/11/2020	N95 3m 8210	2 min		
4/11/2020	N95 3m 8210	2 min		
16-03-21	N95 3m 1860	1 min		
23/3/2021	N95 3m 1860	1 min		
26-03-21	N95 3m 1860	0,5 min		
26-03-21	N95 3m 1860	fallo		
22-04-21	N95 3m 1860	0,5 min		
22-04-21	N95 3m 1860	0,5 min		

Posicion	Tiempo de exposición	Recuento de colonias luego de 24 hs
1 (Fondo)	-	-
2	3,5	0
3	3,5	0
4	-	-
Afuera	0	Alto crecimiento

Descontaminación exitosa en posición central a los 3.5 minutos



ETAPA 3

DEMOSTRACION DE LA AUSENCIA DE DEFORMACION

Autorizado por el Departamento de docencia e investigación ICC

Prueba de sacarina



Prueba de ajuste 7 m



- ENTRENAMIENTO PUESTA MASC
- Prueba del gusto S/M
- Prueba de sacarina S/M
- 1 min respiración normal C/M
- 1 min respiración profunda C/M
- 1 min movimiento lateralización C/M
- 1 min movimiento ascendente C/M
- 1 min lectura en voz alta C/M
- 1 min reverencias C/M
- 1 min respiración normal C/M

Gusto

Gusto

Fallo

Sin gusto

Ajusta



ETAPA 3

DEMOSTRACION DE LA AUSENCIA DE DEFORMACION

Mascarilla **3M N95 9010**

31 Voluntarios ICC

Barbijos sin irradiar

Barbijos Irradiado

	Ajusta	No ajusta	total
Sin irradiar	18	13	31
Irradiados	23	8	31
	Fisher	0.2831	NS
	McNemar	0.134	NS

Fallo

41%

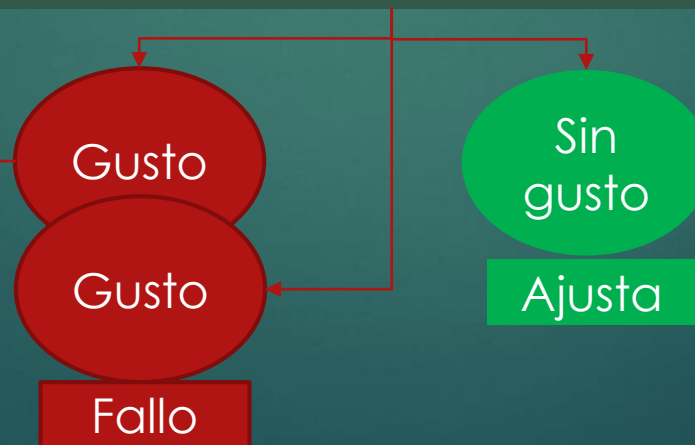
25%



Experiencias test de Ajuste en un centro de alto flujo de pacientes COVID19



- ENTRENAMIENTO PUESTA MASC
- Prueba del gusto S/M
- Prueba de sacarina S/M
- 1 min respiración normal C/M
- 1 min respiración profunda C/M
- 1 min movimiento lateralización C/M
- 1 min movimiento ascendente C/M
- 1 min lectura en voz alta C/M
- 1 min reverencias C/M
- 1 min respiración normal C/M



Experiencias test de Ajuste KN95-2626-2006

- ▶ 10 Pruebas
 - ▶ 5 Fallos a menos de 15 segundos de la prueba
 - ▶ 5 Fallos Ajustados con cinta adhesiva utilizada en el centro (max 80 segundos)



**31
9010**



Fallo
29%

**9
8210**



Fallo
40%

**4
1860S**



**30
Ajustan
96,8%**

**1
Fallo
3,2%**

Filtrado 0.1 a 0.3 micrones (NIOSH EN 13274-7)

- ▶ Sistema de control de la capacidad filtrado
 - ▶ Desarrollo del dispositivo

OBJETIVO

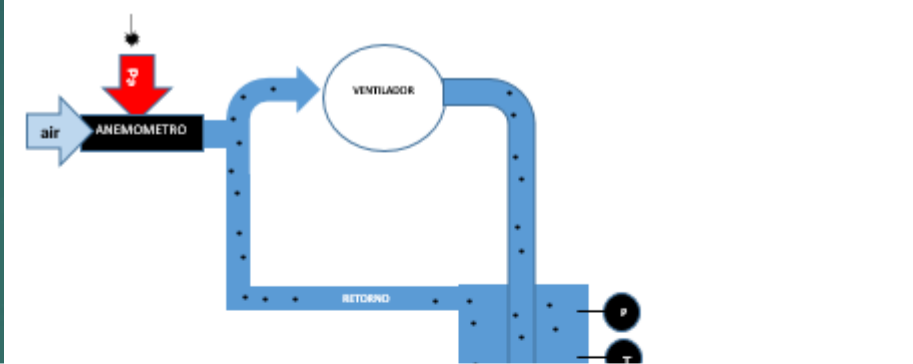
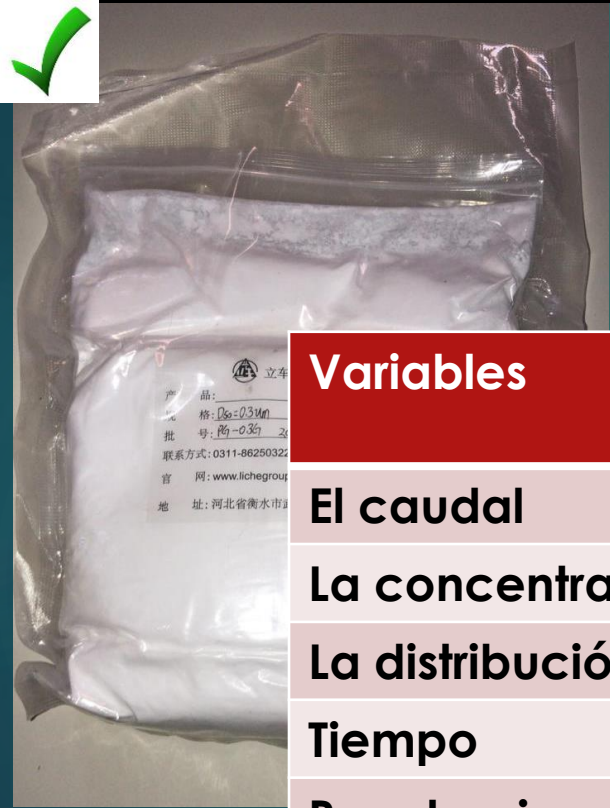
- ▶ Desarrollo de sistemas de evaluación de la penetrabilidad y adecuación de mascarillas N95 (o normas equivalentes), y su eventual aplicación en la selección de sistemas de reciclado, y evaluación de proveedores no habituales



ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION

ALUMINA 0,3 um USD 125



Detector de partículas USD 2000



Variables	NIOSH	Nuestro Equipo
El caudal	85,0 ± 4,0 l/m	85,0 ± 4,0 l/m
La concentración de aerosol	<200 mg/m ³	10000 mg/m ³
La distribución del tamaño de partícula	0.075 ± 0.02um	0,3-0,5um
Tiempo	10 min	10 min
Penetracion	máxima	máxima

RESERVORIO

Temp Hum Pres

Kolamero \$10000

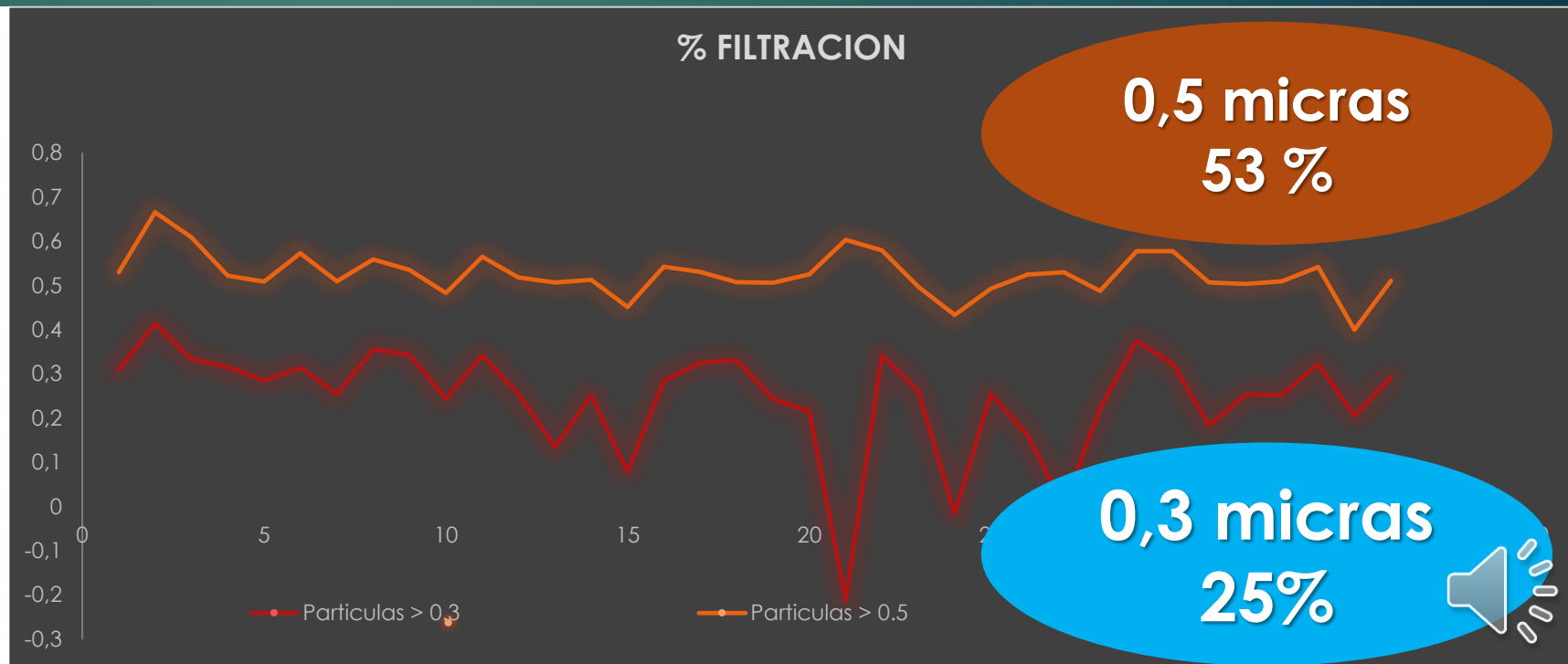
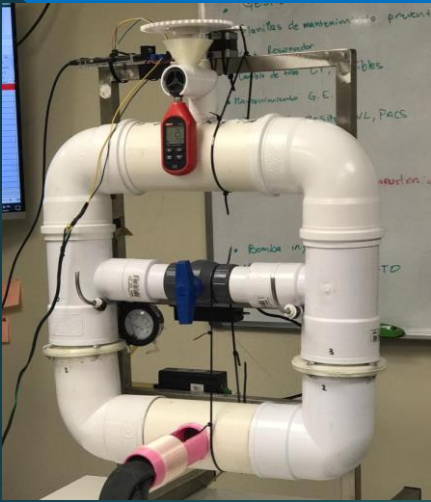


ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION

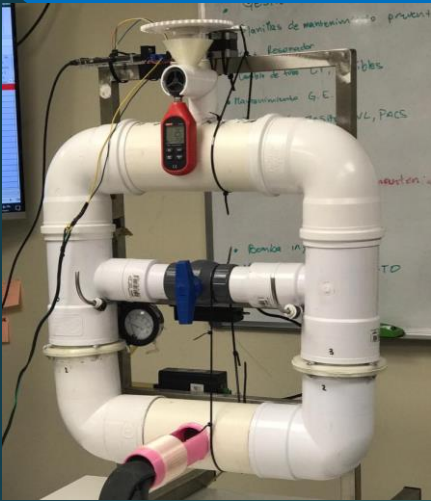
Ferretería

Buena Respirabilidad
Presión diferencial <30pa



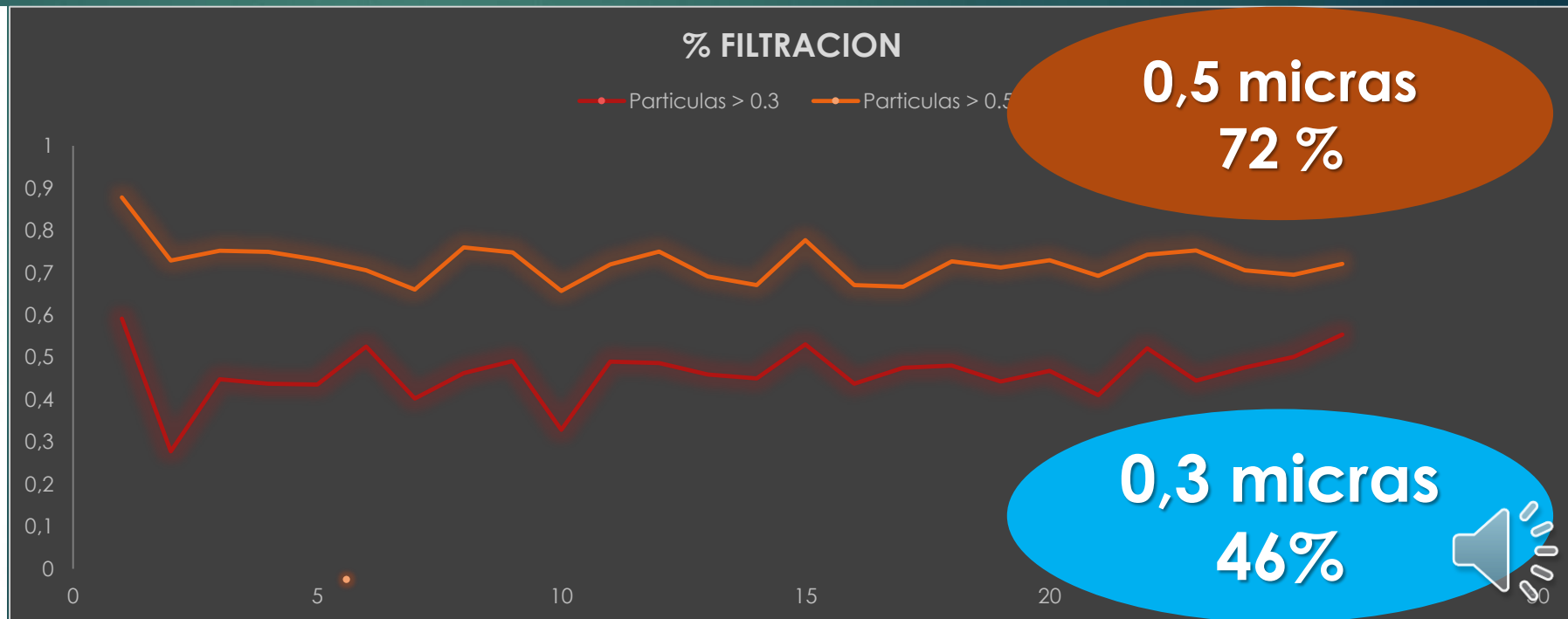
ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION



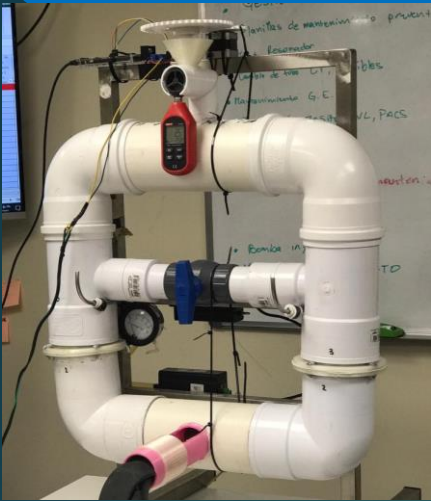
Quirúrgico

Muy Buena Respirabilidad
Presión diferencial <10pa



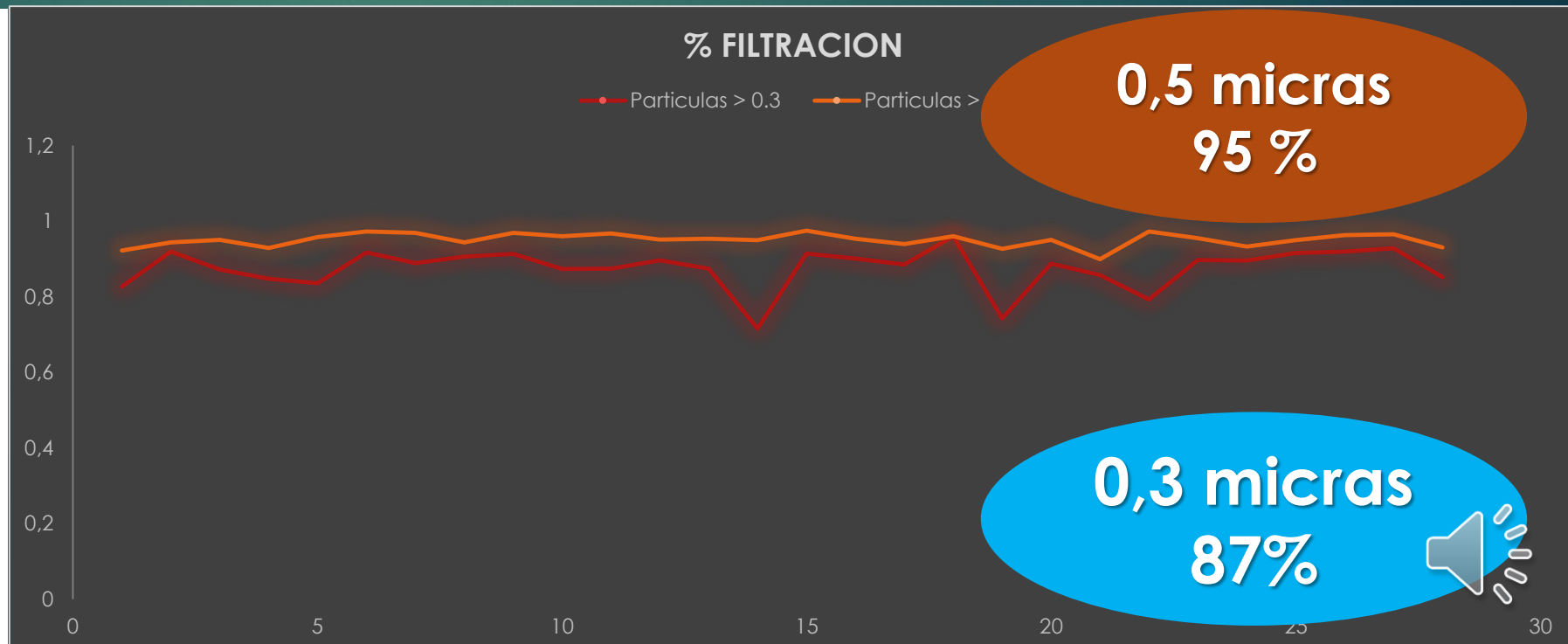
ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION



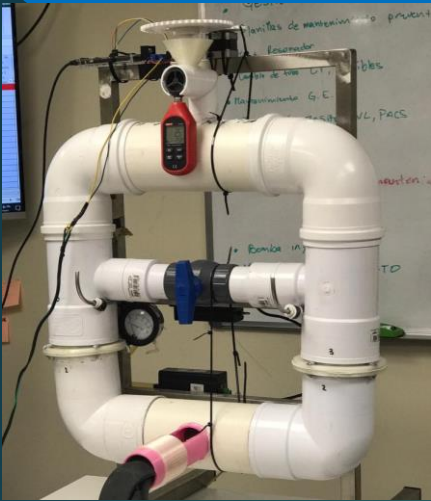
KN95 2626-2006
Dentro

Buena Respirabilidad
Presión diferencial <30pa



ETAPA 4

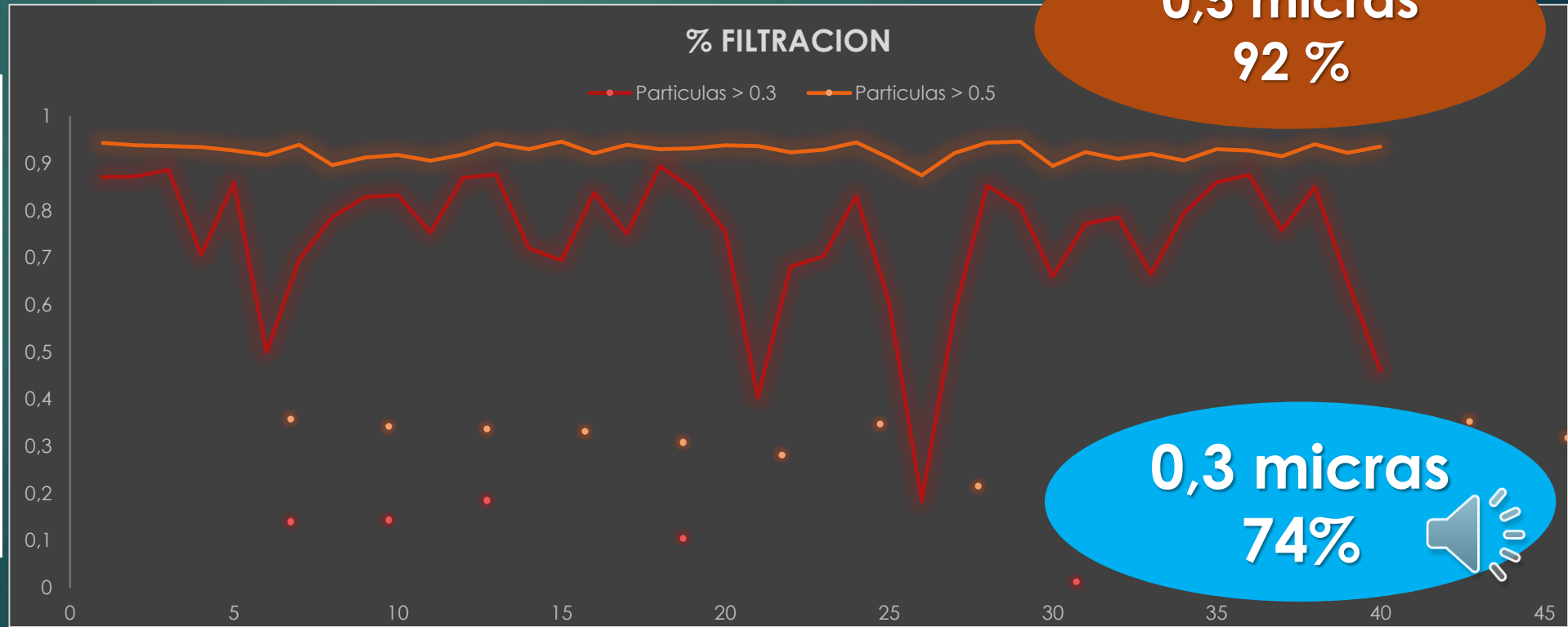
DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION



N95 9010
Dentro No irradiado

Buena Respirabilidad
Presión diferencial <30pa

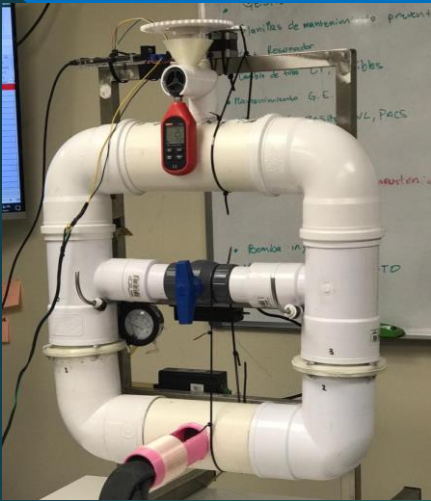
0,5 micras
92 %



0,3 micras
74%

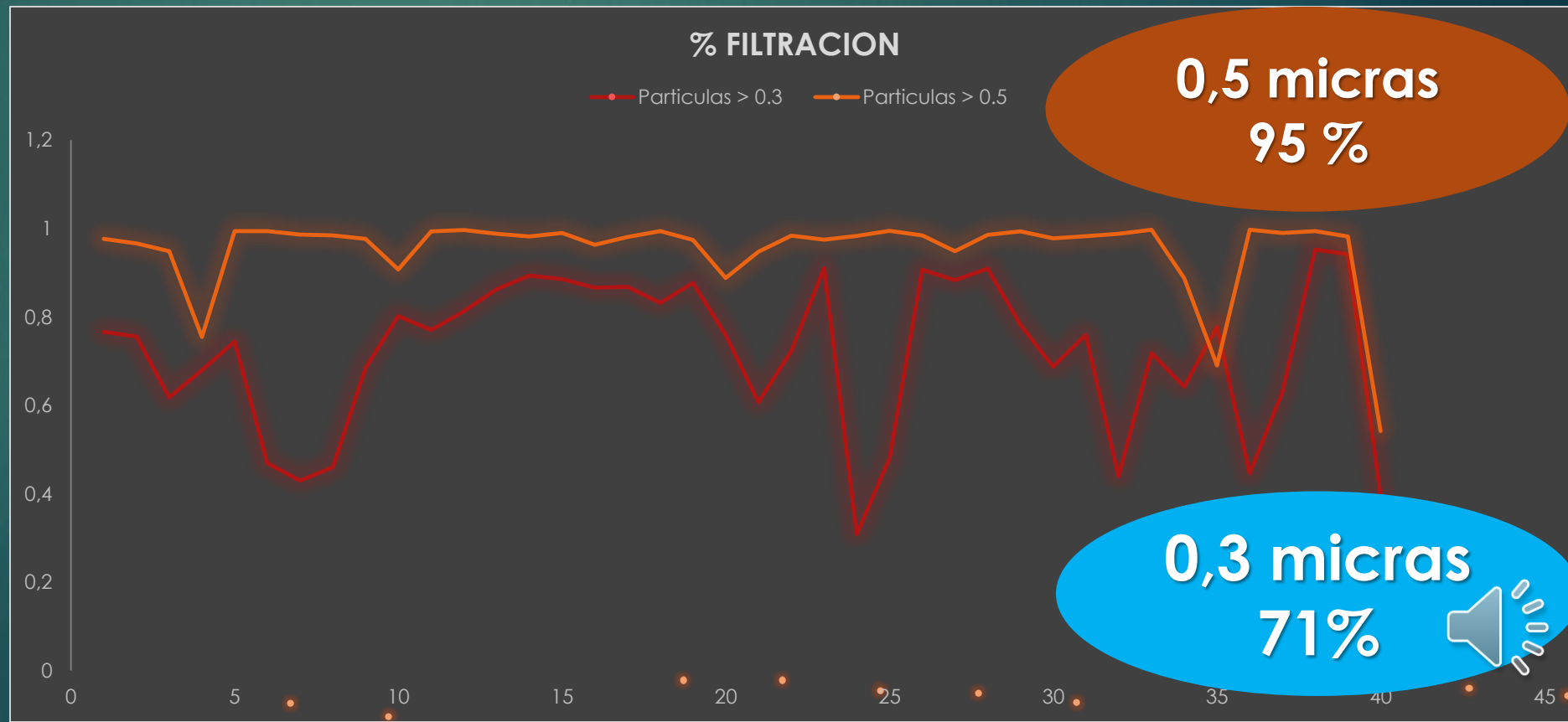
ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION



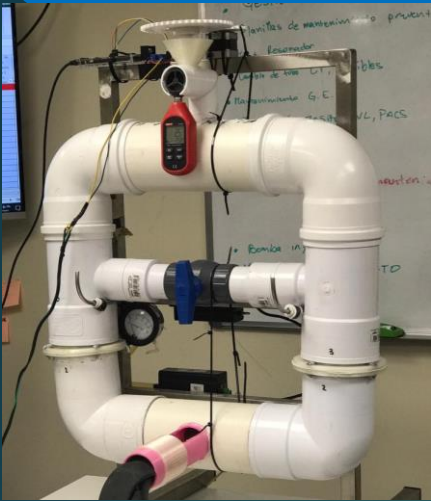
N95 9010
Fuera No irradiado

Buena Respirabilidad
Presión diferencial <45pa



ETAPA 4

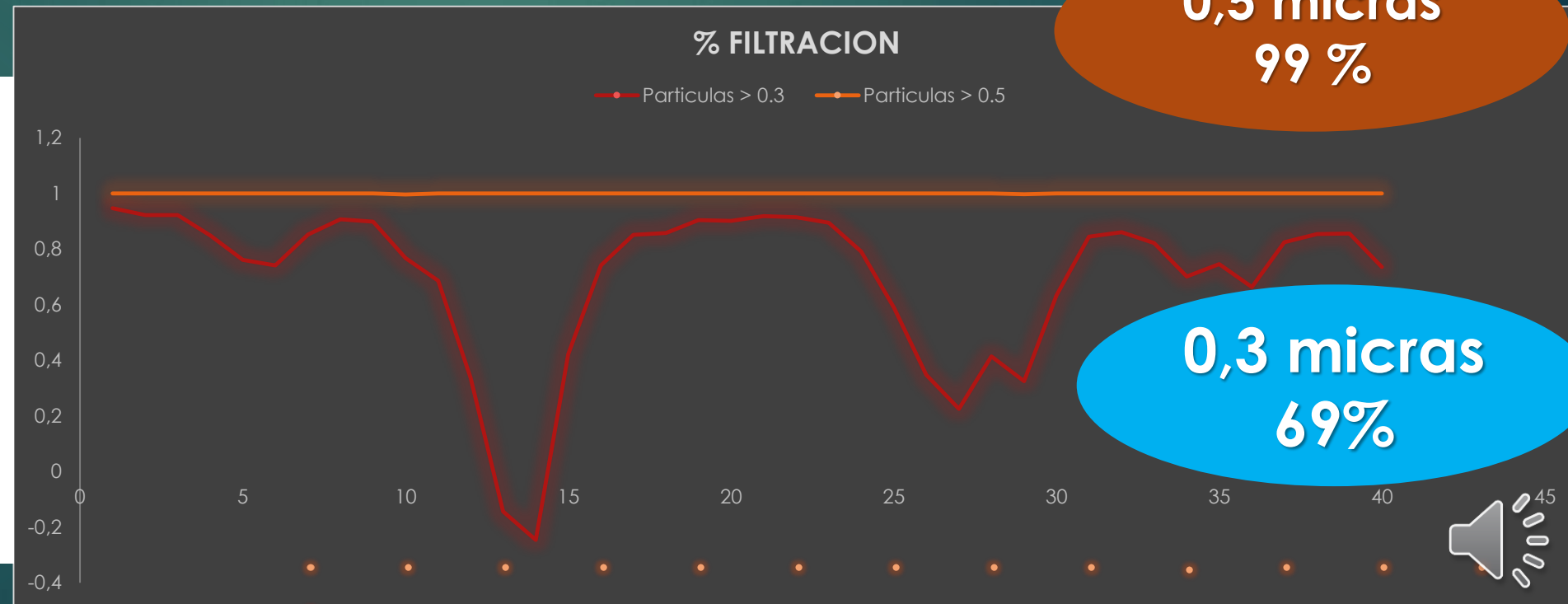
DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION



N95 9010
Dentro Irradiado 20 min

Buena Respirabilidad
Presión diferencial <30pa

0,5 micras
99 %

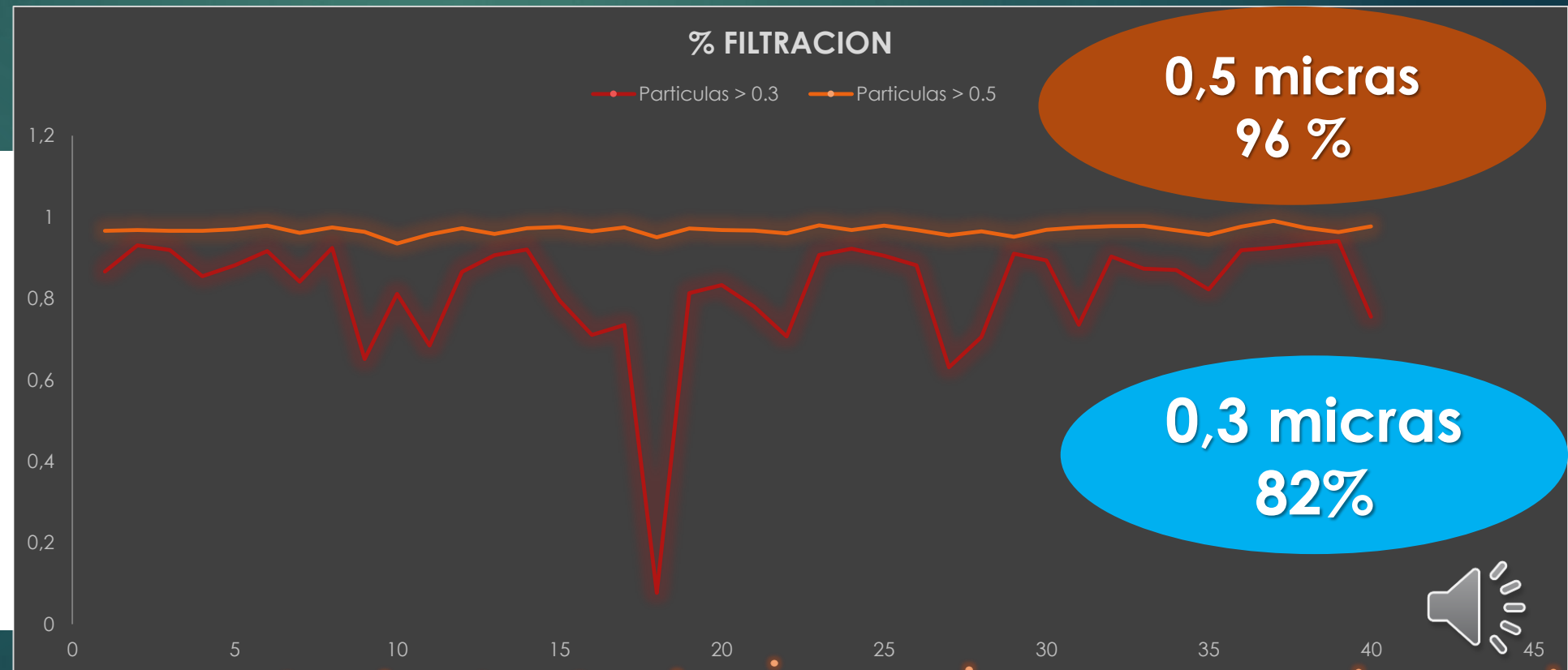
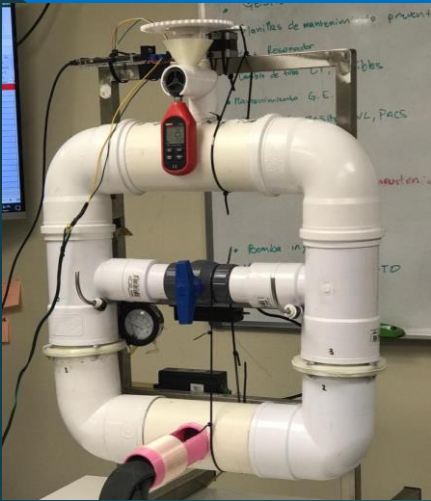


ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION

N95 9010
Fuera Irradiado 20 min

Buena Respirabilidad
Presión diferencial <45pa



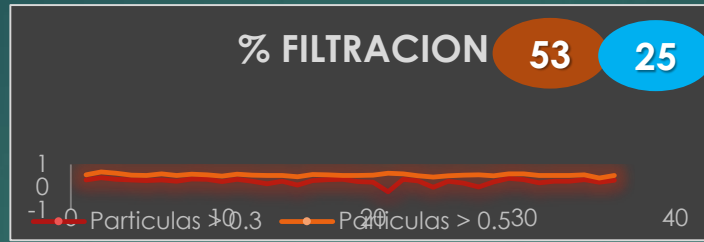
ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION

0,5

0,3

Ferretería



Quirúrgico



KN95 Dentro



N95 9010 Dentro No irr



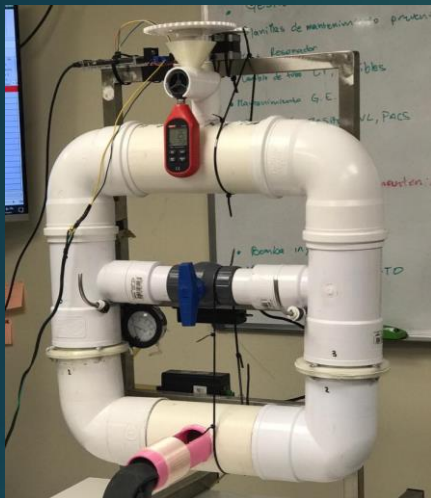
N95 9010 Fuera No irr



N95 9010 Dentro Irr



N95 9010 Fuera Irr



ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION

Resumen N95 9010

irradiado

0,5 micras
93%

Correlación
Spearman
0,88 ps

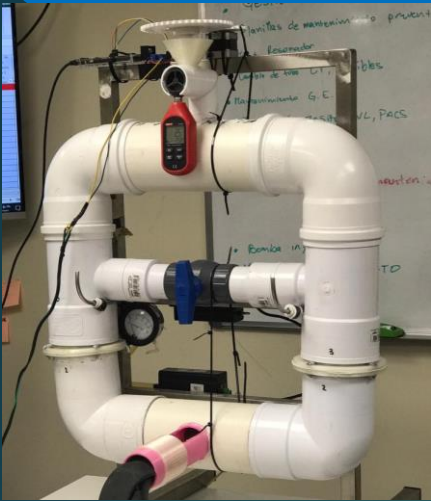
NO irradiado

0,5 micras
98%

0,3 micras
73%

Correlación
Spearman
0,83 ps

0,3 micras
75%



ETAPA 4

DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION

Resumen N95 9010

Dentro

0,5 micras
96%

Correlación
Spearman
0,85 ps

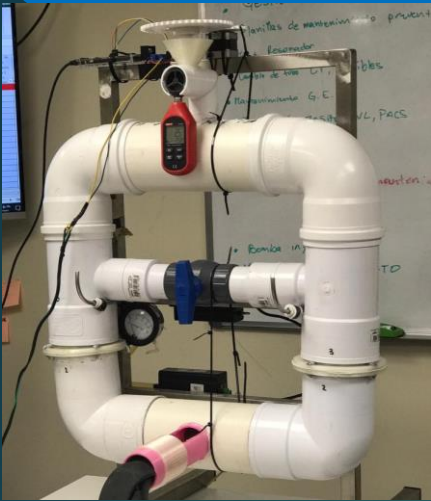
Fuera

0,5 micras
95%

0,3 micras
71%

Correlación
Spearman
0,91 ps

0,3 micras
74%



Proyecto

	ETAPA 1	DISEÑO DE LA LAMPARA
	ETAPA 2	DEMOSTRACION LA CAPACIDAD DE DESCONTAMINAACION
	ETAPA 3	DEMOSTRACION DE LA AUSENCIA DE DEFORMACION
	ETAPA 4	DEMOSTRACION DE LA INDEMNIDAD DE LA FILTRACION



Conclusiones

- ▶ El trabajo en equipo y consorciado fue posible de coordinar (estado, instituciones y profesionales)
OBJETIVO EN COMUN y MUCHO TRABAJO
- ▶ Fase 1: El camino del desarrollo de dispositivos es laborioso requiere de muchos factores trabajando en forma armoniosa programada y constante. Se presentan desafíos nuevos a cada paso
- ▶ Fase 2: la exposición a dosis de radiación tan bajas como 3,5 min alcanzan para evitar el desarrollo de *Stafilococo Aureus* ATCC 6538 usado como trazador
- ▶ Fase 3: no se evidencian cambios en el ajuste luego de la irradiación de mascarillas N95 3M
- ▶ Fase 4: no se evidencian cambios significativos en la permeabilidad con el dispositivo diseñado luego de la irradiación de UVC por 20 min
- ▶ Los KN 95 2626-2006 no ajustan adecuadamente
- ▶ En una población determinada la ausencia de ajuste es muy baja si se realiza la prueba de ajuste administra el modelo adecuado



Conclusiones II

- ▶ El **gabinete de luz UV tipo C** desarrollado, es **factible** como método de **descontaminación** de mascarillas N95 3M para el **re-uso** de las mismas durante la pandemia **COVID19**

