

The background of the slide is filled with numerous small, red, hollow triangles scattered across the white space. The triangles are distributed in a somewhat random pattern, with some clusters and some isolated points. They are all oriented with their apex pointing upwards.

Superheated Steam Worker Safety

General concepts about the technology

- ✓ Superheated steam (SHS) is steam that is given additional heat at a constant pressure. The steam that is given additional heat (energy) to become gas above the boiling point. Superheated steam does not contain any mist or water droplets
- ✓ In contrast to saturated steam, a decrease in temperature will not lead to condensation unless the temperature decreases to the saturation point. Sometimes it is called “dry steam”.
- ✓ Superheated steam can penetrate crevices that are difficult to clean using physical dry cleaning strategies.

The Equipment

- ✓ Superheated steam temperature ranges from 125° to >300°C.
- ✓ Superheated steam sanitation equipment can be roll-along, backpack, or side-pack unit.
- ✓ The unit contains a water reservoir, and the heat generator is located on the gun.



Potential risks of using this technology

- ✓ Superheated steam is an odorless, colorless gas which can cause skin burns.
- ✓ Both Saturated and Superheated steam may cause dust or emission of harmful particles or gasses if directed at an inappropriate surface.
- ✓ Superheated steam can heat surfaces quickly to high temperatures and the equipment can stay hot for a few minutes after use.



MORE INFORMATION ABOUT SAFETY & RISKS OF THE TECHNOLOGY ARE IN A DIFFERENT TRAINING MATERIAL AVAILABLE AT <https://blogs.cornell.edu/snyder/training-material/>

Operating guidelines

- ✓ Water should be always flowing through the device during operation. Failure to achieve this might result in overheating and damage to the unit.
- ✓ The unit requires very little water per hour in operation.
- ✓ Ensure at least 1 L of water is in the reservoir at the start of each use.
- ✓ Distilled water or filtered water is recommended. Tap water should not be used.
- ✓ Although the heat disperses relatively quickly from the nozzle, all other employees should **maintain at least 3 ft of distance from the operator** when the SHS unit is in use.

Operating guidelines

- ✓ Do not point nozzle at any surface you do not intend to treat with superheated steam
- ✓ No "horseplay" when operating the superheated steam unit
- ✓ Make sure the outlet is GFCI for electrical safety purposes
- ✓ Do not point at flammable objects or those sensitive to deformation

These objects could include:

- ✓ Paper
- ✓ Cardboard
- ✓ Rubber
- ✓ Chemicals



- ✓ Although objects may not immediately ignite, the risk of fire increases with exposure

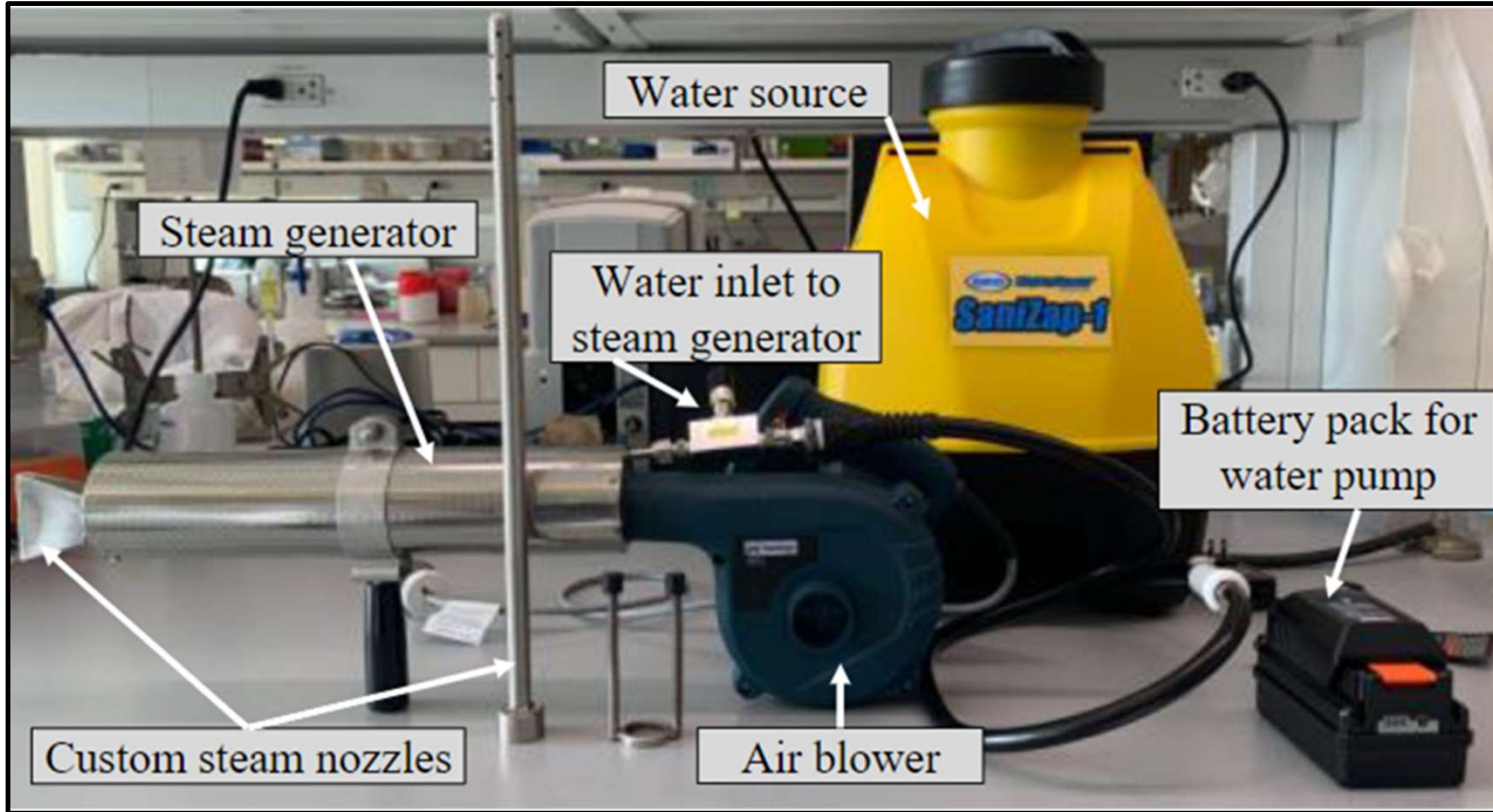
Personnel Safety Summary

Always:

- Wear heat resistant gloves, eye protection, a lab coat, closed-toed shoes (no cloth tennis shoes), long pants/sleeves, and tie back any hair prior to handling the equipment.
- Maintain the equipment's nozzle in the horizontal position when applying the treatment. *Do not tilt the nozzle upward.*
- Inform the researcher and place the equipment back to the designated location if you become tired or the equipment becomes too heavy.
- Inform the researcher if you contact the heating element or feel elevated temperatures.
- Remain in the designated experimentation area.

Never:

- Touch the heating element or nozzle of the equipment with bare skin. Do not try to touch the steam emitted.
- Point the nozzle at another person or other flammable object.





Note the following:

- Appropriate safety equipment
 - Heat-resistant gloves
 - Lab goggles
 - Lab coat
 - Long pants
 - Closed-toed shoes
- Firm grip on the handles
- Horizontal application of the nozzle
 - *Do not tilt the nozzle downward/upward*
- Distance from the hot regions of the gun
 - *Do not put your hands in front of the nozzle or touch the steam generator.*

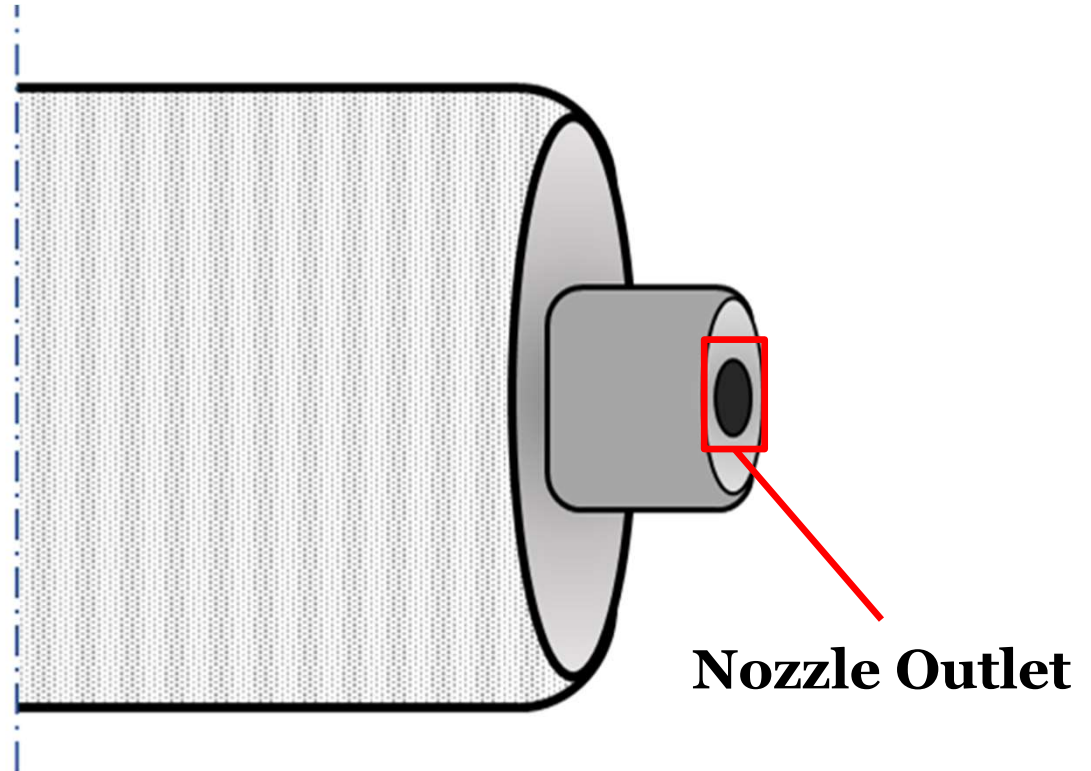
During the experimentation:

1. Inform the researcher that you are *ready* to proceed.
2. Firmly grasp the superheated steam gun via the two designated handles.
3. Remove directly upward and move to the designated start location.
4. Apply the superheated steam treatment directly onto the surface.
 - Researchers will record how you apply the superheated steam equipment to the surface.
5. Inform the researcher that you *completed* the treatment and return the equipment to the designated area.



Operating Parameters

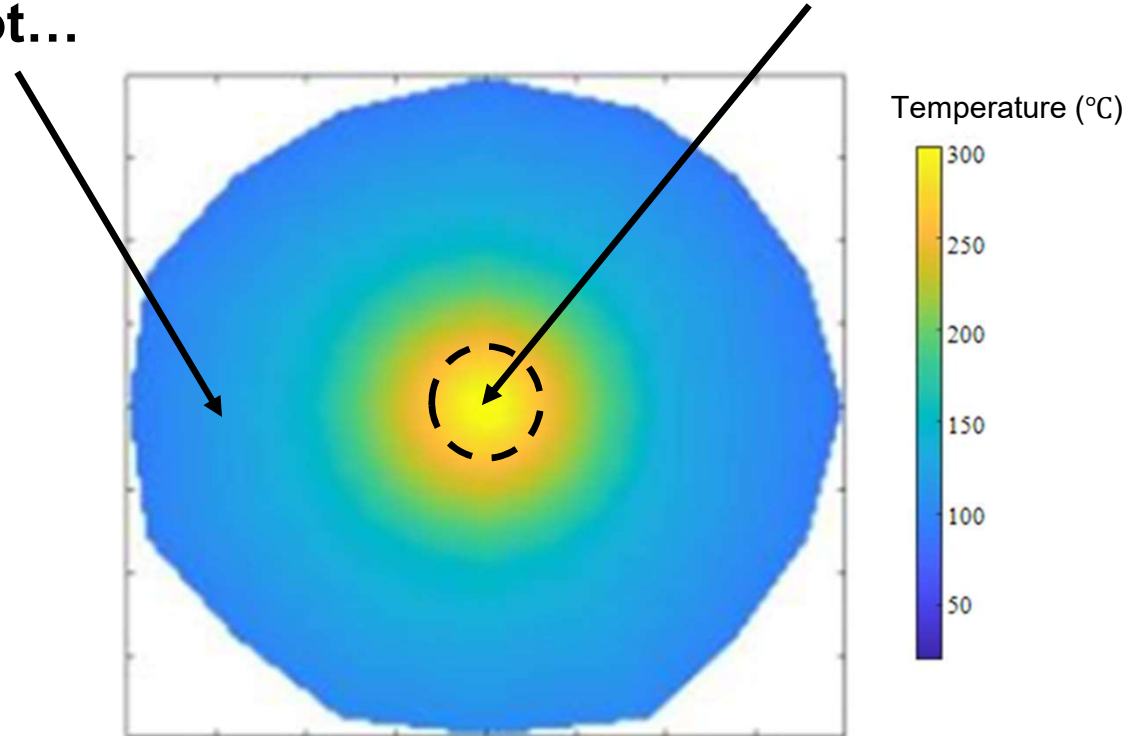
Temperatures
are the
HOTTEST at
the equipment
**NOZZLE
OUTLET.**



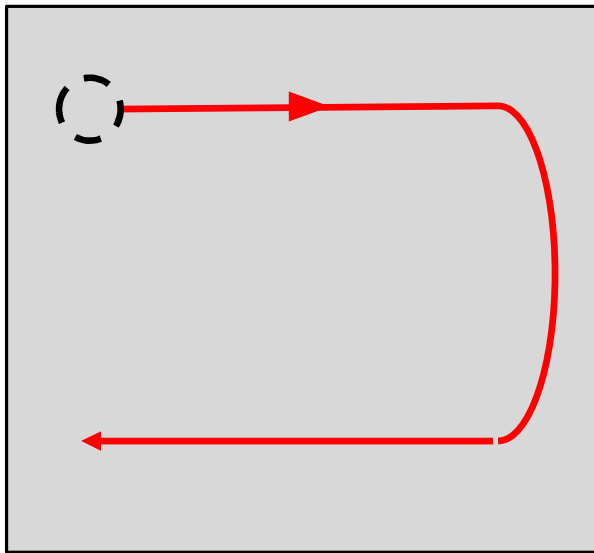
The gun kills
MORE
pathogens when
CLOSER to
nozzle outlet!

FURTHER from
nozzle outlet!
Less Hot...

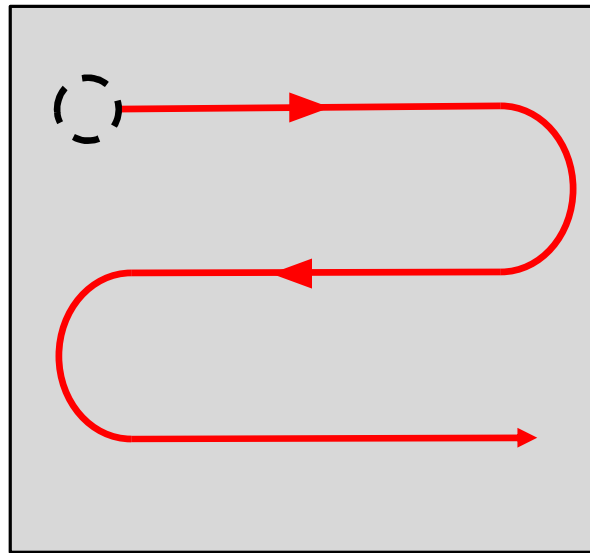
At Nozzle Outlet!
HOTTEST!



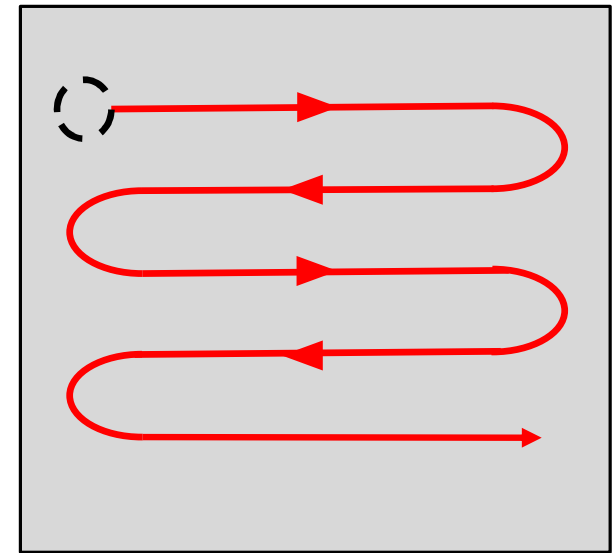
Be **THOROUGH** with the gun on the surface to kill **MORE** pathogens!



**TOO BIG OF
TRACES
POOR!**

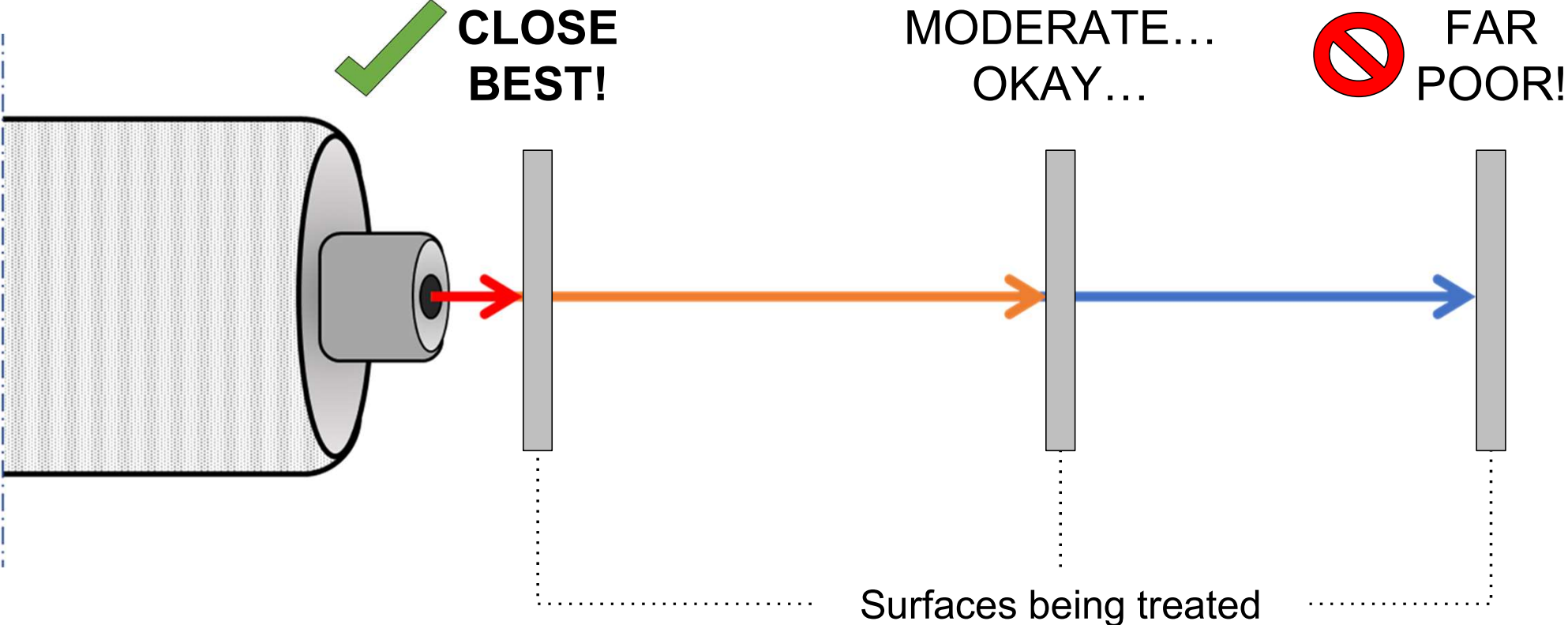


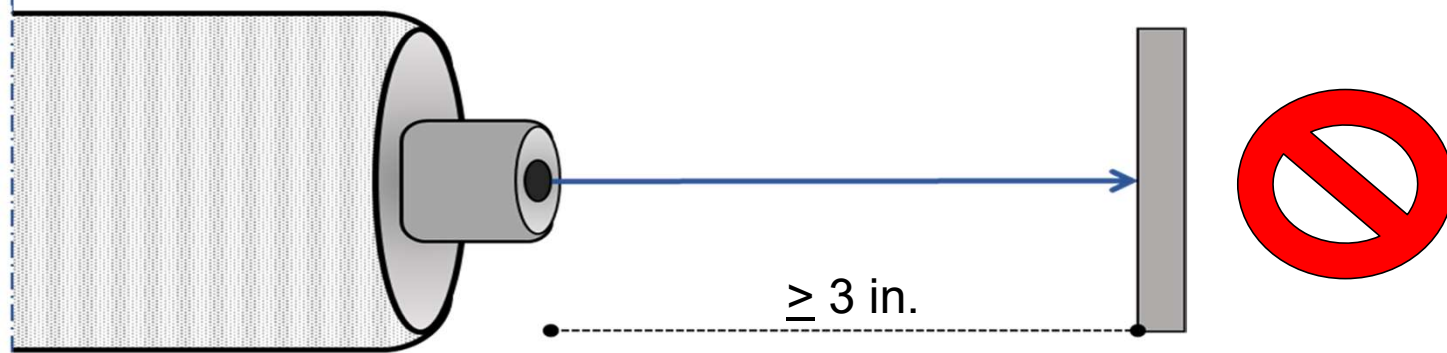
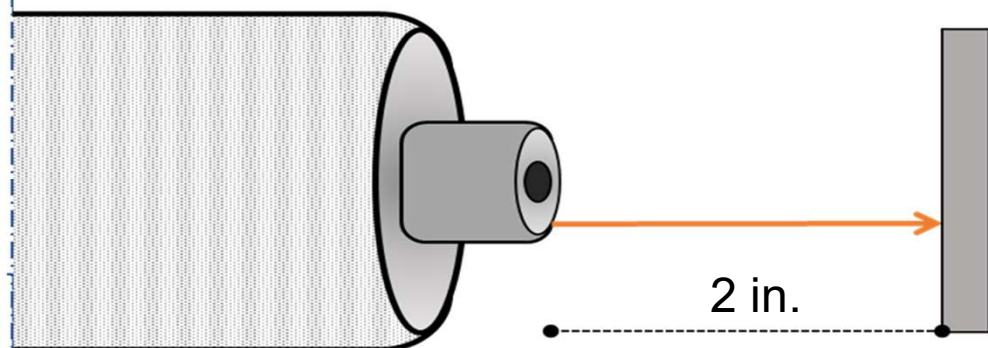
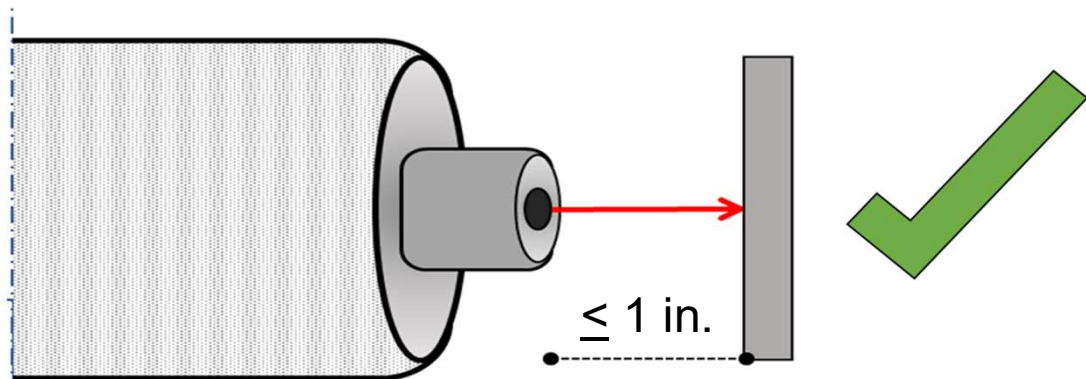
**MODERATE
OKAY...**



**THOROUGH
TRACES
BEST!**

The surface temperature is **HOTTER** when **CLOSER** to the nozzle outlet!

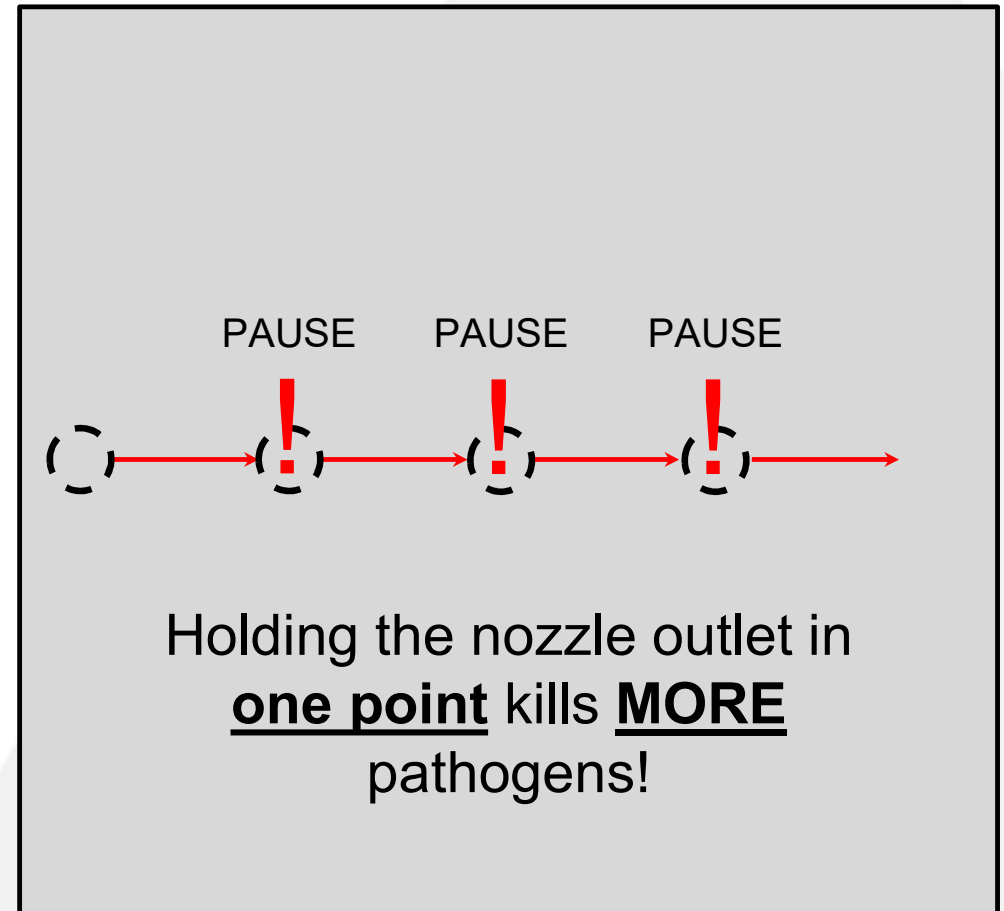




The gun kills **MORE** pathogens when the nozzle outlet is **CLOSER** to the surface!

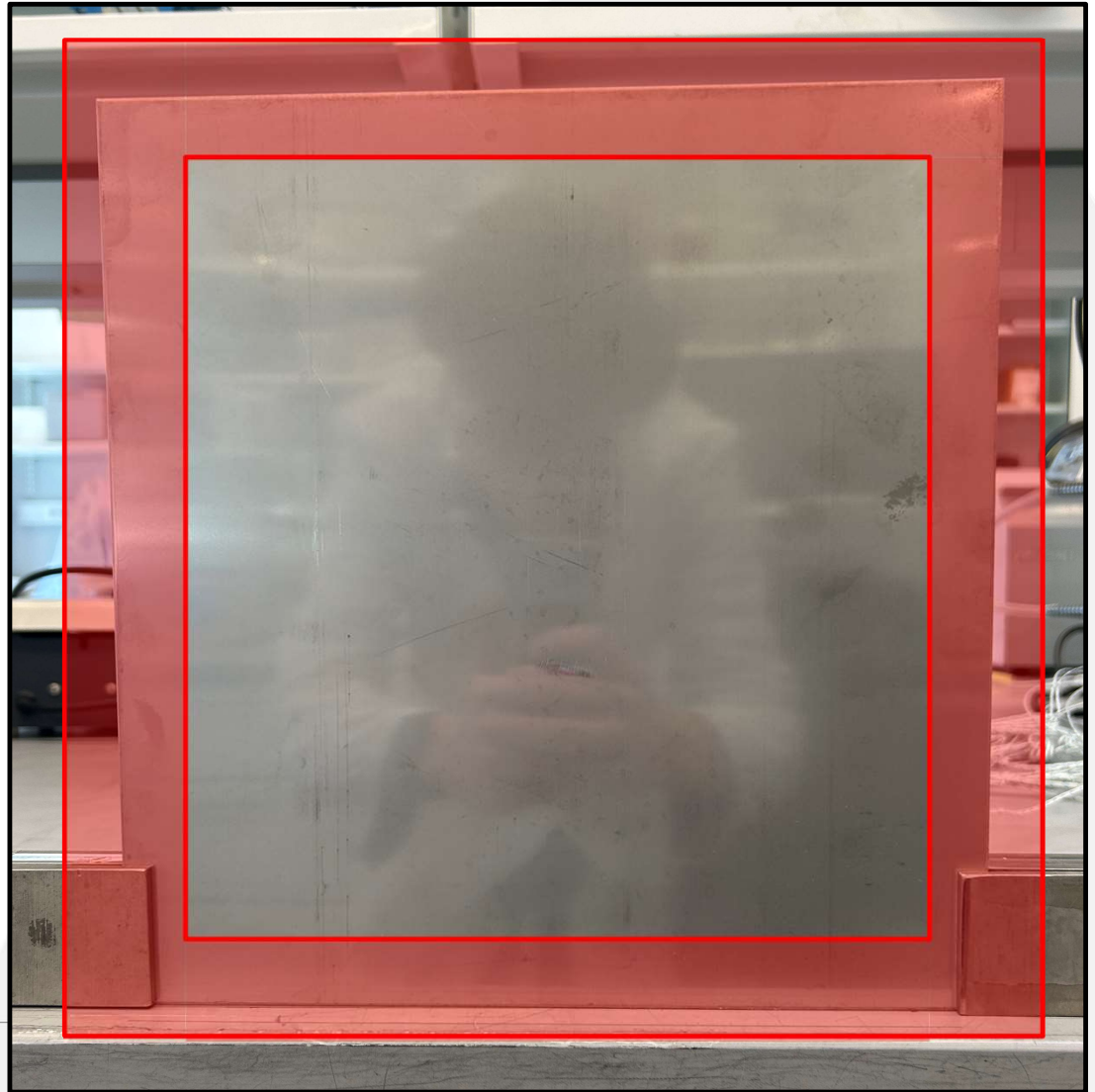
The surface temperature is **HOTTER** when treatment times are **LONGER!**

Kills **MORE** pathogens with **LONGER** treatment times!



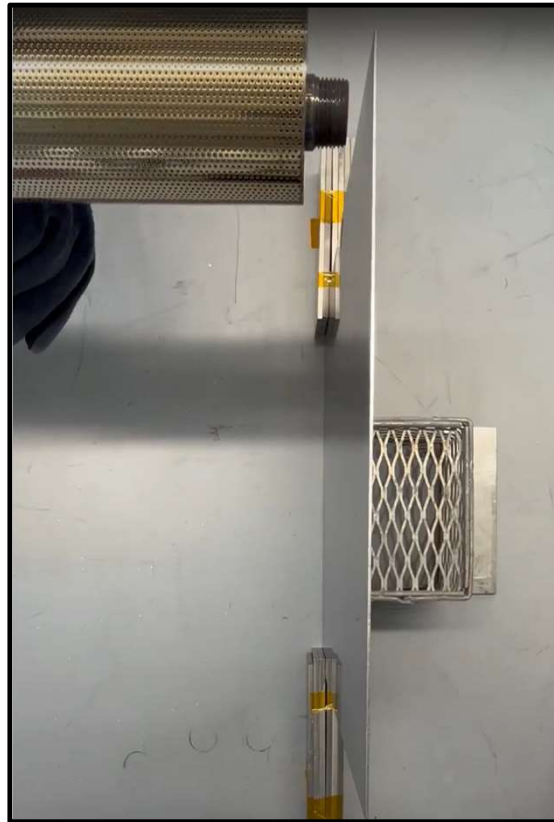
Apply the treatment even to the **EDGES** of the coupon!

Be thorough! The pathogens could be anywhere on the surface.

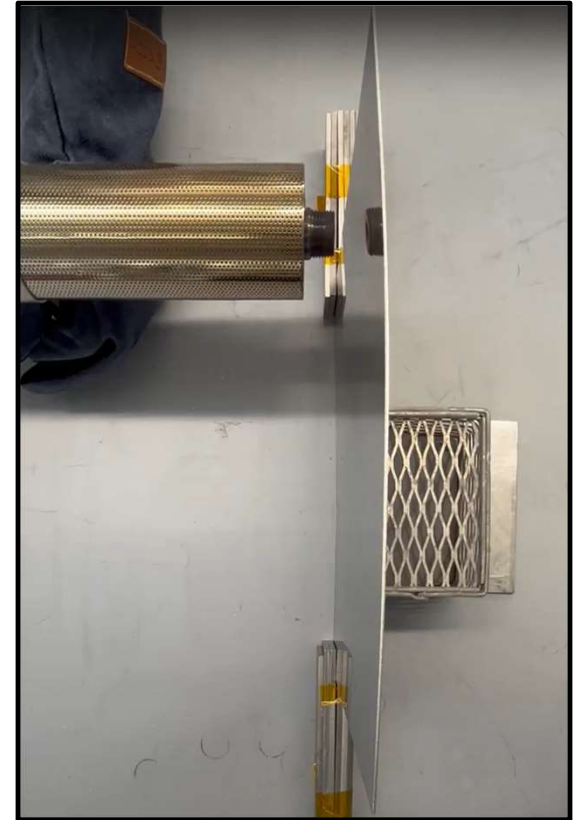




**TOO FAST!
POOR!**



**MODERATE
OKAY**




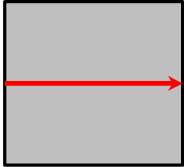
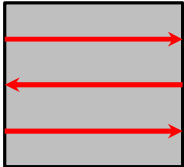
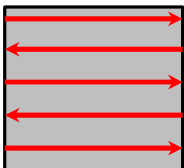
**SLOW!
BEST!**

Distance from Surface

Speed

Moving the Nozzle

Surviving Pathogens

NONE	NONE		NONE
VERY FAR	VERY FAST		VERY FEW
FAR	FAST		FEW
CLOSE	SLOW		THOROUGH
VERY CLOSE	VERY SLOW		VERY THOROUGH

Which row
would kill the
most
pathogens?

Key Learnings:

- ≤ 1 in (2.54 cm) distance from surface
- ≥ 10 traces
- ≥ 12 s per trace (≥ 2 min treatment)
- Include the edges of the coupon in the treatment



**10 Passes
at 2 minutes**

Support for these training materials was provided by:

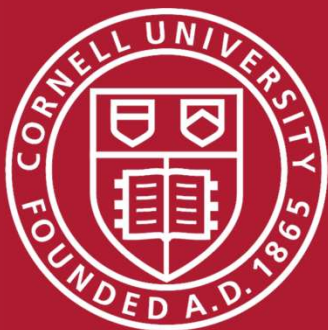


CPS contributed funding to support research to employee safety standards



USDA NIFA contributed funding to support the development of these employee training materials

Questions?



Cornell **CALS**

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Thank you