HOSE STREAM MECHANICS

LESSON PLAN

EXTERIOR SUPPRESSION

STUDENT OBJECTIVE

Given the information from discussion, handouts, and video references, the student will demonstrate knowledge of employing different stream types, application patterns, stream angles, and methods of deflection to effectively apply water during exterior suppression operations.

The student will also demonstrate the importance of minimizing the amount of air entrained into the hose stream during exterior suppression operations.

MOTIVATION

Learning how to employ different stream types, application patterns, stream angles, and methods of deflection will assist the nozzle operator in fireground decision-making to most effectively distribute water and map the surfaces of a fire compartment during exterior suppression operations.

Initially employing a straight or solid stream, via a steep angle, will coat all interior surfaces of the compartment simultaneously, rapidly reducing temperatures inside the fire room and adjoining spaces. The drop in temperatures causes the fire gases to contract, decreasing pressure, and improving survivability throughout the structure.

INSTRUCTOR NOTES

Single 1½ or 1¾ inch handline with the ability to switch between a combination nozzle and smooth bore nozzle set to a flow and pressure of your choice.

Full personal protective ensemble (PPE) recommended.

The streamer flags to visualize air entrainment should be installed and in place at the entrance of the hallway prior to the start of this evolution.

The door from the hallway to the room should be open and the door from the end of the hallway to the outside of the prop should be closed.

ASSOCIATED REFERENCES

Fire Attack Study
Coordinated Fire Attack Study

LEARN MORE

Visit fsri.org/hose-stream-mechanics

LESSON: IMPACT OF STREAM ANGLE

1 PERPENDICULAR STREAM ANGLE

Watch a Demonstration of this Exercise

Technique
Apply water through the prop window, in a straight or solid stream, perpendicularly to the hallway wall in the prop directly across from the room entry door.

Nozzle Setting: Straight or Solid Stream

Outcome
Water will radiate outwards around the point of impact in 360 degrees.

Discussion
When applying a hose stream perpendicular to a surface, the water will radiate 360 degrees. We often picture that as a stream applied straight ahead towards a wall as seen here. Now think about applying this stream to the overhead of a fire compartment and how water would radiate in all directions across the ceiling.

2 SHALLOW STREAM ANGLE

Watch a Demonstration of this Exercise

Technique
Apply water through the prop window, in a straight or solid stream, in a shallow angle to the ceiling of the room nearest the back wall, opposite the window.

Nozzle Setting: Straight or Solid Stream

Outcome
Water will propel forward along the ceiling to the back wall of the room and coat this wall only as the water falls to the floor in sheets.

Discussion
The shallower the angle into the compartment, the more the water will be propelled forward towards whatever wall or obstruction is opposite the opening in which the water is being applied.

This does not provide any surface cooling to the ceiling and walls that are nearest the ventilation opening, where most of the burning is occurring.

3 STEEP STREAM ANGLE

Watch a Demonstration of this Exercise

Technique
Apply water through the prop window, in a straight or solid stream, in a steep angle to the ceiling of the room nearest window wall.

Nozzle Setting: Straight or Solid Stream

Outcome
Water will radiate outward in 360 degrees, propelling water in all directions across the ceiling to all side walls, and coat all walls simultaneously as the water falls to the floor in sheets.

Discussion
The steeper the angle into the compartment, the more the water will radiate outwards in all directions, providing better surface coverage and better cooling. As the stream impacts the ceiling and the water radiates outward, the momentum of the water carries it across the flat ceiling surface common in residential structures.

Once the water has coated the ceiling surface and reaches the side walls of the compartment, it flows down these surfaces in sheets. As the water reaches the floor, it accumulates and pools in different areas depending on the obstructions that may or may not be present. This water application method nearly simultaneously coats all surfaces within a compartment and is effective in fire suppression.

During fire suppression, initially employing a steep stream to coat all interior surfaces simultaneously, will rapidly reduce temperatures inside the fire compartment. The drop in temperature causes the fire gases to contract, decreasing pressure, lowering temperatures, and improving survivability in adjoining spaces.

4 VARYING STREAM ANGLE

Watch a Demonstration of this Exercise

Technique
Apply water through the prop window, in a straight or solid stream, beginning with a shallow angle to the ceiling nearest the back wall. Without closing the bale, adjust the stream angle on the ceiling towards the window wall in a steep angle to the ceiling of the room nearest window wall.

Nozzle Setting: Straight or Solid Stream

Outcome
Water will begin to coat more and more of the ceiling and wall surfaces in the compartment as the stream angle changes from shallow to steep.

Discussion
It may not always be possible to achieve a steep angle into the compartment due to the ability of the nozzle firefighter to get into an ideal position on the fireground. It is therefore important to understand how the stream angle changes the resulting distribution as it varies between shallow and steep within the compartment.

LESSON: FOLLOW-UP APPLICATIONS TO LIMIT FIRE REGROWTH

5 ON-PLANE APPLICATION

Watch a Demonstration of this Exercise

Technique
Walk up to the window, open the bale, insert nozzle into the opening and whip it around in a circular pattern

Nozzle Setting: Straight, Solid or Fog Stream

Outcome
Water will distribute into the center of the compartment to wet areas previously uncovered with the traditional steep angle approach during initial knock-down.

Discussion
Once the interior surfaces have been cooled and we have begun to knock down the fire, we must focus on getting water into the middle of the compartment to limit the likelihood of regrowth.

If we are on the same level as the fire, the nozzle can simply be inserted into the window, and additional water can be applied to the remaining burning fuels.

This can be achieved through a straight, solid, or fog stream and either partial or full-bale. This tactic is employed after fire is no longer showing from the window and the nozzle firefighter can approach the opening safely.

6 OFF-PLANE APPLICATION

Watch a Demonstration of this Exercise

Technique
Apply water from the exterior of the compartment to the window header, or lintel, of the main opening into the room or to the header of the window in the gable wall of the attic to generate a broken stream.

Nozzle Setting: Straight or Solid Stream

Outcome
Water will distribute into the center of the compartment to wet areas previously uncovered with the traditional steep angle approach during initial knock-down.

Discussion
If we are located on a floor or two below the fire, the hose stream can be deflected off the window header, or lintel, to achieve additional distribution, followed by entry into the structure for final extinguishment.

To learn more or access additional training, visit fsri.org/hose-stream-mechanics

LESSON: IMPACT OF AIR ENTRAINMENT

7 FOG STREAM FULL OCCLUSION

Watch a Demonstration of this Exercise

Technique
Apply water into the window of the prop via a narrow fog stream in an attempt to occlude the opening.

Nozzle Setting: Narrow Fog Stream

Outcome
The streamers located at the start of the hallway will deflect outwards to show the amount of air entrained by the fog stream and the magnitude of this air moving through the structure.

Discussion
It is important to understand that utilizing a straight or solid stream during exterior water application is essential to ensure we get the most amount of water into the compartment, with the highest momentum, the largest droplet sizes, all while entraining the least amount of air.

When we use a fog stream, we magnify the amount of air entrainment which will cause gases to move about the structure and potentially impact any trapped victims and firefighters operating on the interior. Fire gases will be redirected to another low- pressure outlet within the structure. This is commonly referred to as 'pushing fire.'

8 STRAIGHT OR SOLID STREAM NO OCCLUSION

Watch a Demonstration of this Exercise

Technique
Apply water into the window of the prop via a straight or solid stream in an attempt to avoid occluding the opening.

Nozzle Setting: Straight or Solid Stream

Outcome
The streamers located at the start of the hallway will show little to no movement indicating minimal air entrainment and no hazard to firefighters or victims located in the hallway or other areas outside of the fire compartment.

Discussion
Ensure that the window opening is not occluded with the hose stream. An occluded vent will prevent the opening from serving as a low-pressure exhaust for fire gases.

Keeping the hose stream in a straight or solid pattern will limit the amount of air entrained and not disrupt fire gases outside of the fire compartment.