The following is just the

Executive Summary,

pages 2-4, from the full report titled,

“Study of the Effectiveness of Fire Service Positive Pressure Ventilation During Fire Attack in Single Family Homes Incorporating Modern Construction Practices”

This was taken from the full Scientific Report retrieved April 19, 2016 from www.ulfirefightersafety.com/wp-content/uploads/2016/04/Positive_Pressure_Ventilation_Report_Website.pdf

Link available at http://ulfirefightersafety.com/projects_blog/ul-fsri-releases-final-reports-on-ppappv/

The Fire Service Summary Report (70 pages): http://www.ulfirefightersafety.com/wp-content/uploads/2016/04/Positive_Pressure_Ventilation_FD_Summary_Report_Website.pdf

The Fire Service Summary Report is also available, hosted on ventry.com, cropped tightly and formatted to save some paper, **to print on 35 pages** (small): http://ventry.pics/pdfs/ul-study...

Online Positive Pressure Attack Training Course based on this study: http://www.ulfirefightersafety.com/wp-content/uploads/Courses/PPV/story.html

Ventry Solutions, Inc. is the OEM of Ventry® Fans and one of the PPV fan manufacturers which participated in the UL PPV study.

Study of the Effectiveness of Fire Service Positive Pressure Ventilation During Fire Attack in Single Family Homes Incorporating Modern Construction Practices

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Executive Summary

There is a continued tragic loss of firefighter and civilian lives, as shown by fire statistics. One significant contributing factor is the lack of understanding of fire behavior in residential structures resulting from the use of ventilation as a firefighter practice on the fire ground. The changing dynamics of residential fires as a result of the changes in home construction materials, contents, size and geometry over the past 30 years compounds our lack of understanding of the effects of ventilation on fire behavior. Positive Pressure Ventilation (PPV) fans were introduced as a technology to increase firefighter safety by controlling the ventilation. However, adequate scientific data is not available for PPV to be used without increasing the risk to firefighters.

This fire research report details the experimental data from cold flow experiments, fuel load characterization experiments and full scale fire experiments. During the project it was identified that the positive pressure attack (PPA) and positive pressure ventilation (PPV) were often used interchangeably. For the purpose of this report they have been defined as PPA for when the fan is utilized prior to fire control and PPV for when the fan is used post fire control.

The information from the full scale tests was reviewed with assistance from our technical panel of fire service experts to develop tactical considerations for the use of PPV fans in residential single family structures. A summary of these tactical considerations are as follows:

Understanding the Basics of Positive Pressure Ventilation/Attack - An understanding of pressure, how pressure creates flow, and how flow is associated with ventilation is essential to fully understanding if PPA or PPV will be either effective or in effective in ventilating a residential single family structure.

Horizontal, Vertical and Positive Pressure Attack are different tactics. - No one tactic will work in every scenario. Understanding the fire environment with emphasis on ventilation limited fire dynamics and how fire department operations impact those will ensure the tactic chosen is most effective.

The setback of the fan or development of a cone of air is not as important as the exhaust size. - In the application of PPA a great deal of emphasis has been placed on the flow occurring at the front door. Ensuring the "cone of air" does not equate to most effective flow. An aqueduct size exhaust is more important for creating the intended flow.

During PPA, an ongoing assessment of inlet and exhaust flow is imperative to understanding whether or not a fan flow path has been established and if conditions are improving - The fire attack entrance cannot tell you the conditions at the exhaust location(s). Assessing both the inlet, exhaust locations and interior conditions together provide the best assessment of PPA effectiveness.

Positive Pressure Attack is Exhaust Dependant. - For PPA to be effective the pressure created by the fan must be greater than the pressure created by the fire. Although fan size does play a role in the effectiveness of PPA, exhaust size plays a greater role. Providing enough exhaust to reduce the pressure in the fire room below what the fan is capable of producing in the remainder of the structure is essential for safe PPA operations.

An outlet of sufficient size, must be provided, in the fire room to allow for effective PPA. - PPA effectiveness is directly dependent on the ability of the fan to exhaust products of combustion to the exterior. Any exhaust opening created in conjunction with PPA should be located in the fire compartment.

During PPA, creating additional openings not in the fire room will create additional flow paths making PPA ineffective with the potential to draw the fire into all flow paths. - Additional openings not in the fire compartment, will lower the pressure in the adjacent compartments, allowing for more flow from the fire compartment to the remainder of the structure.

The safety of PPA is decreased when the location and extent of the fire is not known with a high degree of certainty. - To ensure the exhaust is provided in the most effective location it is essential to identify the location of the fire. Several indicators are available to aid firefighters in this identification such as heat signatures identified via thermal imaging cameras and smoke/neutral

plane conditions.

PPA will not be effective on a fire located in an open concept floor plan or any floor plan with high ceilings. - In order for positive pressure attack to be effective, the fan must be capable of increasing pressure in the adjacent compartments. This forces the products of combustion out of the structure rather than into adjacent compartments. This pressure increase is only possible where the fire is located within a compartment.

The application of water, as quickly as possible, whether from the interior or exterior prior to initiating PPA will increase the likelihood of a successful outcome. - The application of water onto a compartment fire has been shown to slow the growth rate, increasing firefighter and occupant safety while decreasing property loss. This makes rapid hose line deployment a top priority for first arriving crews. Although positive pressure attack can improve the efficiency of a hose stretch, is not a substitute for the application of water on the seat of the fire. This early application of water will aid in the effectiveness of PPA.

PPA is not a replacement for using the reach of your hose stream. - Although PPA can reduce temperatures as crews approach a fire, it is not a replacement for the reach of a hose stream. Applying water as you approach the fire reduces the heat release rate making PPA most effective.

During PPA, extension into void spaces is directly related to the exhaust capabilities of the void space. - In order for fire extension into the void space there must be an entrance (penetration) for the fire and an exit(exhaust) for the products of combustion to leave.

PPA does not negatively affect the survivability of occupants behind a closed door. - Prior research shows the importance of having a closed door between occupants and the fire if they are unable to escape. These PPA experiments reinforced this assessment as temperatures and gas concentrations in the closed or isolated rooms remained tenable while conditions in open compartments exceeded tenability thresholds.

When PPV is used, in single story residential structures, the more openings made in the structure during PPV (Post Knockdown) the more effective it is at ventilating the structure. - The 18 in. gas fan used was capable of moving so much air it could exhaust through more than 5 times the inlet size to most efficiently remove products of combustion. As the number of exhaust points increased the exhaust flow continued to increase. The greater the exhaust flow, the faster the structure was ventilated.

When PPV is used, it is important to assess for extension. - While the fan provides additional visibility after fire control by exhausting products of combustion out of the structure faster, it also has the potential to hide extension in void spaces. Directing attention to these spaces immediately following knockdown will limit the possibility of extension.

When PPV is used, starting or turning in the fan immediately after fire control will provide the most benefit. - Once water is on the fire and the attack crew has the upper hand, fans will assist with increasing visibility and reducing temperatures to ambient to allow for other fire ground operations like search, rescue and overhaul to happen faster and more efficiently. The use of the fan must be coordinated with interior crews and incident command to ensure fire control has been achieved.