

This report is a compilation of a series of backdraft experiments carried out as a part of the project "Backdraft and Underventilated Fire", a three year project carried out for Räddningsverket (The Swedish National Rescue Service Agency). The purpose of the project is partly to develop a backdraft scenario that can be used in the education of fire fighters. A so-called backdraft container has been built to serve as a demonstrator device as well as an experimental apparatus. A total of 13 backdraft experiments have been carried out in the backdraft container, 8 of the experiments were successful and backdraft occurred. Natural gas has served as fuel during the experiments. Gas temperatures, gas concentrations as well as dynamic and static pressures were measured in the experiments. It has been hard to get reliable results from the measurements mainly due to the fact that there are two time-scales involved in a backdraft situation. First there is a long time scale when the container is heated and a combustible gas concentration is built up. Next is there a short time scale when fresh air enters the compartment and ignition occurs. Even though some of the quantitative results may have a large margin of error, the experiments give a reasonable qualitative explanation of the backdraft phenomena. As an example, the gas measurements show that the oxygen concentration will be as low as 3 % when the flame goes out. This is not a very reasonable value, a value of 12 % would seem more appropriate. However, when looking at the oxygen concentration versus time curve the backdraft event can be well understood. First, the oxygen level decreases while burning occurs in the compartment. When the flame goes out, the oxygen level decreases further at a much slower rate due to dilution. When an opening is made to the compartment, the oxygen level increases until ignition of the combustible mixture occurs. At this point, all the combustible gas in the compartment ignites suddenly and is combusted in a dramatic fireball. This makes the oxygen concentration drop very suddenly to a very low level. Finally when the combustion has taken place, the oxygen level is restored to its ambient value. To continue the research on backdraft the measurement techniques must be refined. The fuel used in future experiments should be "normal" fuel such as wood and plastic products in order to make a connection to a real-case backdraft scenario.