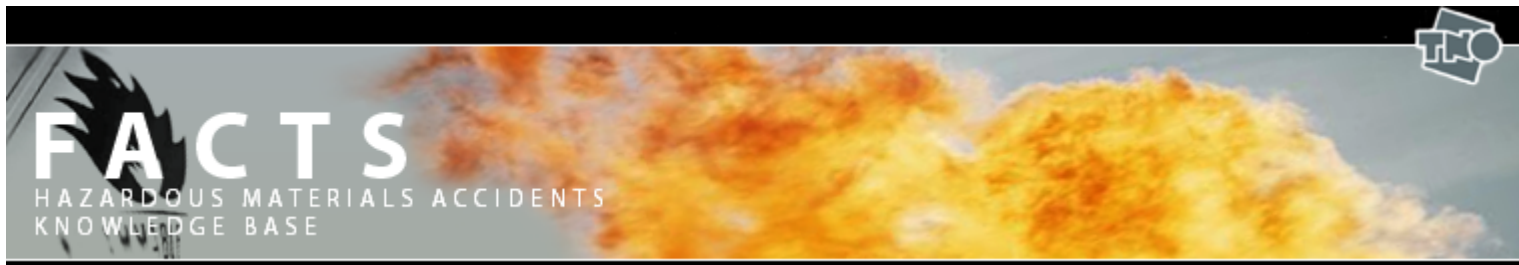


**Hoe kom je aan goede  
ongevalsinformatie?**

**Hoe kun je ongevalsinformatie  
goed analyseren?**

**Achilles**



**Hoe kom je aan goede ongevalsinformatie?**

**FACTS #21437**

| <b>FACTS</b>   |                           | <b>Accident Nr.</b>                                |
|--|---------------------------|--|
| <b>Database with hazardous materials used for industrial safety<br/>maintained by the Department of Industrial Safety of TNO<br/>Coded Accident Abstract</b> |                           | <b>21437</b>                                       |
| <b>Identification :</b>  |                           |  |
| <i>Type</i>  | <i>Value</i>              | <i>Text</i>  |
| CLASS  | *****                     | -  |
| ABSTR  | EXTENDED ABSTRACT ENGLISH | -  |
| ADDRESS  | USA                       | -  |
| ADATE  | 2005                      | -  |
| TIME   |                           | 0646   |
| ACTIV  | USE/APPLICATION           | PRIVATE  |
| LOCTN  | HOME                      | TRI-LEVEL WOOD-FRAMED RESIDENCE                    |
| SURR   | RESIDENTIAL QUARTER       | -  |
| ENCIR  | HUMID                     | 70% HUMIDITY                                       |
| ENCIR  | TEMPERATURE               | -9/C   |
| <b>Cause :</b>   |                           |  |
| <i>Type</i>  | <i>Value</i>              | <i>Text</i>  |
| CAUSE  | OP/OTHERS-EXT/FAIL        | SPONTANEOUS COMBUSTION                             |
| <b>Accident description :</b>  |                           |  |
| <i>Type</i>  | <i>Value</i>              | <i>Text</i>  |
| OCCUR  | WRONG-ACTION              | DISABLED   |
| EQINV  | FIRE DETECTION SYSTEMS    | SMOKE DETECTORS                                    |
| OCCUR  | WRONG-ACTION              | DOOR BETWEEN OLD AND NEW BASEMENT WAS              |
| OCCUR  | WRONG-POSITION            | CLOSED   |
| OCCUR  | CHEMICAL REACTION         | SPONTANEOUS COMBUSTION OF                          |
| EQINV  | OTHER EQUIPMENT           | OIL-SOAKED RAGS                                    |
| CHEM   | OIL N.O.S.                | -  |
| STATE  | LIQUID                    | -  |
| OCCUR  | FIRE                      | IN   |
| EQINV  | BUILDING                  | BASEMENT OF TRI-LEVEL RESIDENCE                    |
| EQMADE   |                           | WOOD-FRAMED  |
| EQDATE   |                           | 1950S  |
| AREA   |                           | 167-372/M2   |
| EQACT  |                           | ADDITION TO ORIGINAL RESIDENCE IN SUMMER 2004      |
| OCCUR  | SMOKE-EMISSION            | LIGHT SMOKE CONDITIONS                             |
| OCCUR  | DAMAGE                    | FIRE DAMAGED                                       |
| EQDM   | WIRE                      | HOME'S TELEPHONE WIRES                             |
| OCCUR  | DEFECTIVE-WORKING         | TRIED TO CALL 911 WITH HOME TELEPHONE              |
| OCCUR  | DEFECTIVE-WORKING         | TRIED TO CALL 911 WITH CELL PHONE                  |
| OCCUR  | SAFETY-MEASURES           | OTHER PERSON CALLED 911                            |
| TIME   |                           | 0711   |
| OCCUR  | FIRE-FIGHTING             | 1 FIREFIGHTER AND 1 CAREER CAPTAIN RESPONDED       |
| OCCUR  | HUMAN-OPERATIONS          | OPENED GARAGE DOOR                                 |
| OCCUR  | SMOKE-EMISSION            | LIGHT GREY SMOKE CONDITIONS                        |
| OCCUR  | HUMAN-OPERATIONS          | OPENED DOOR LEADING TO INTERIOR                    |
| OCCUR  | SMOKE-EMISSION            | BLACK SMOKE BANKED DOWN TO FLOOR                   |
| OCCUR  | SAFETY-MEASURES           | ASKED FOR MORE FIREFIGHTERS                        |
| OCCUR  | FIRE-FIGHTING             | MADE ENTRY INTO STRUCTURE TO SEARCH FOR FIRE       |
| PSA/PPE  |                           | SELF-CONTAINED BREATHING APPARATUS (SCBA)          |
| EQINV  | LINE                      | HANDLINE   |
| DPIPE  |                           | 44/MM  |
| TIME   |                           | 0713   |
| OCCUR  | FIRE-FIGHTING             | PUMP OPERATOR RESPONDED IN PRIVATE VEHICLE         |
| TIME   |                           | 0714   |
| OCCUR  | FIRE-FIGHTING             | INCIDENT COMMAND (IC) RESPONDED                    |
| OCCUR  | SWITCH                    | RESPONDING UNITS SWITCHED FROM DISPATCH CHANNEL TO |
| OCCUR  | SWITCH                    | FIREGROUND CHANNEL                                 |
| TIME   |                           | 0721   |
| OCCUR  | FIRE-FIGHTING             | 2 FIREFIGHTERS RESPONDED                           |
| OCCUR  | FIRE                      | CONDITIONS WORSENER                                |
| OCCUR  | UNDERPRESSURE             | LOW WATER PRESSURE                                 |
| OCCUR  | RECOVER                   | QUICKLY RESTORED WATER PRESSURE                    |

|        |                         |  |
|--------|-------------------------|--|
| OCCUR  | SAFETY-MEASURES         | STARTED  |
| EQINV  | VENTILATOR              | POSITIVE PRESSURE VENTILATION (PVV) FAN IN         |
| EQINV  | BUILDING                | INTERIOR DOOR OF GARAGE                            |
| OCCUR  | HUMAN-OPERATIONS        | FIRE CAPTAIN TOOK OUT TO DISTINGUISH OR SMELL FIRE |
| EQINV  | FIRE-FIGHTING EQUIPMENT | REGULATOR  |
| OCCUR  | DEFECTIVE-WORKING       | NO LONGER OPERATING ON FIREGROUND CHANNEL          |
| EQINV  | FIRE-FIGHTING EQUIPMENT | FIRE CAPTAIN'S RADIO                               |
| OCCUR  | HUMAN-OPERATIONS        | FIRE CAPTAIN PUT REGULATOR BACK IN                 |
| OCCUR  | SAFETY-MEASURES         | LOW AIR ALARM OF FIREFIGHTER SOUNDED               |
| OCCUR  | SAFETY-MEASURES         | FIREFIGHTER EXITED HOME, OTHER WENT IN             |
| OCCUR  | WRONG-ACTION            | FLOODED  |
| EQINV  | VENTILATOR              | PPV FAN  |
| OCCUR  | REPLACE                 | REPLACED PPV FAN                                   |
| OCCUR  | WRONG-ACTION            | FIREFIGHTER TOOK OUT REGULATOR                     |
| OCCUR  | SAFETY-MEASURES         | LOW AIR ALARM OF FIRE CAPTAIN SOUNDED              |
| OCCUR  | FIRE-FIGHTING           | 2 FIREFIGHTERS WENT INTO BASEMENT SEARCHING FIRE   |
| OCCUR  | HEATING                 | HIGH HEAT CONDITIONS FORCED 2 FIREFIGHTERS TO EXIT |
| OCCUR  | WRONG-ACTION            | FIRE CAPTAIN AND FIREFIGHTER BECAME DISORIENTED    |
| TIME   |                         | 0732   |
| OCCUR  | SAFETY-MEASURES         | CALLED IC FOR ASSISTANCE 3 TIMES                   |
| OCCUR  | SAFETY-MEASURES         | GAVE MAYDAY STATING                                |
| TIME   |                         | 0736   |
| OCCUR  | SAFETY-MEASURES         | FINAL MAYDAY CALL                                  |
| OCCUR  | SAFETY-MEASURES         | BUDDY BREATHING                                    |
| OCCUR  | FALL                    | FIRE CAPTAIN COLLAPSED AND BECAME UNRESPONSIVE     |
| OCCUR  | SAFETY-MEASURES         | BUSTED OUT IN ATTEMPT TO SIGNAL SOMEONE            |
| EQDM   | WINDOW                  | WINDOW AT FRONT OF STRUCTURE                       |
| OCCUR  | WRONG-ACTION            | FIREFIGHTER BECAME DISORIENTED AND LOW ON AIR      |
| OCCUR  | FIRE-FIGHTING           | FIREFIGHTER EXITED BUILDING                        |
| OCCUR  | EVACUATION              | IC ORDERED STRUCTURE TO BE EVACUATED               |
| OCCUR  | WRONG-ACTION            | APPARATUS HORNS NOT USED TO SIGNAL EVACUATION      |
| OCCUR  | FIRE-FIGHTING           | CREW WENT INSIDE TO CONDUCT SEARCH                 |
| OCCUR  | BREAK                   | BROKE TO VENTILATE                                 |
| EQDM   | WINDOW                  | ALL WINDOWS  |
| OCCUR  | COLLAPSE/DESTROY        | COLLAPSED  |
| EQDM   | ROOF                    | FLOOR IN LIVING ROOM AREA                          |
| OCCUR  | FIRE                    | FIRE CONDITIONS BECAME UNTENABLE                   |
| OCCUR  | SAFETY-MEASURES         | EXITED BUILDING                                    |
| OCCUR  | DAMAGE                  | FIRE DAMAGED                                       |
| EQDM   | BUILDINGS/HOUSINGS      | RESIDENCE  |
| FATALS | FIREMAN                 | 1  |
| INJURS | FIREMAN                 | 3  |
| WNDNG  | TOXIC-INHALATION        | SOOT AND SMOKE INHALATION                          |
| WNDNG  | POISONING               | CARBON MONOXIDE POISONING                          |
| WNDNG  | POISONING               | CARBOXYHEMOGLOBIN LEVEL OF 22.7%                   |
| TREATM | HOSPITAL                | 4 (1 PRONOUNCED DEAD)                              |
| DRWNG  |                         | 2  |
| PHOTO  |                         | 3  |
| LESSON |                         | SEE EXTENDED ABSTRACT                              |

**Summary :**

|       |  |
|-------|--|
| SCENE | SPONTANEOUS COMBUSTION OF OIL-SOAKED RAGS AND      |
| SCENE | DISABLE SMOKE DETECTORS CAUSED FIRE IN BASEMENT OF |
| SCENE | RESIDENCE, POLLUTION OF AIR AND 4 CASUALTIES       |

**Extended abstract :****Accident Nr. 21437**

**This information has been compiled by TNO with the greatest care from qualified source documents. TNO cannot accept responsibility for any inaccuracy**

Country: UNITED STATES OF AMERICA (USA)  
Date : 2005 0120

A 39-year-old male career Captain (the victim) died after he ran out of air, became disoriented, and then collapsed at a residential structure fire. Three other firefighters were hospitalized after suffering smoke inhalation. The International Association of Firefighters (IAFF) and the U.S. Fire Administration (USFA) notified the National Institute for Occupational Safety and Health (NIOSH) of the fatality. A Safety

and Occupational Health Specialist, a Safety Engineer, and a General Engineer from the NIOSH Division of Safety Research investigated the incident. Meetings were conducted with the State Police Fire Investigator, IAFF representative, and officers of the fire department. Interviews were conducted with officers and firefighters who were at the incident scene. The NIOSH investigators reviewed the department's standard operating procedures (SOPs), the fire department's incident report, the victim's training records, the medical examiner's report, photographs, and drawings of the site. The incident site was visited and photographed.

#### Department

The combination department involved in this incident is comprised of 16 career and 12 volunteer firefighters operating out of two stations.

#### Training

The State requires that all firefighters receive Firefighter I and Firefighter II training. The victim was National Fire Protection Association (NFPA) Level I- and Level II-certified, and he had also received training for fire officer, leadership, instructor orientation, and firefighter health and safety. He had more than 20 years of fire fighting experience.

#### Structure

The structure was a tri-level, single family wood-frame residence of ordinary construction which encompassed approximately 167-372/m<sup>2</sup> that was built in the 1950s. The room of fire origin was an addition to the original residence that was structurally completed in the summer of 2004. Interior finish work was still being completed in the addition. The smoke detectors were disabled by the homeowner during the new construction project.

#### Units for Initial Alarm

Multiple departments were dispatched to this incident; however, only those units directly involved in operations preceding the fatal event are discussed in the investigation section of this report:

Engine 1 (Firefighter #1/driver, Captain/ victim)

Engine 2 (Firefighter #2/driver, firefighter)

Rescue 1 (Incident Commander)

Privately Owned Vehicle (volunteer firefighter/pump operator)

#### Weather

The conditions were clear with light winds and temperatures averaging -9/C. The average humidity was 70%.

#### Investigation

The 39-year-old male career Captain (the victim) died when he ran out of air, became disoriented, and then collapsed at a residential structure fire. The alarm was delayed for 15-20/minutes because the fire damaged wires, and when the owner tried to call 911 on his cell phone, the call did not go through. He then went to a neighbours' house but could not wake them. Finally, he called someone else he knew, and that person called 911. At 0704 hours Central Dispatch received a call of a possible garage fire and dispatched the local fire department at 0706 hours. The victim and firefighter #1 arrived on the scene in engine 1 at 0711 hours with little to no smoke showing from the front of the structure.

The owner met the victim and firefighter #1 in his driveway and stated that the house was unoccupied with light smoke conditions. The owner opened the garage door which revealed light grey smoke conditions inside the garage. The victim opened a door leading to the interior and thick black smoke was banked down to the floor as the smoke pushed out into the garage. The victim radioed Central Dispatch to dispatch another engine and have them stand by at the closest hydrant. He also told Central Dispatch to advise the other responding units of the conditions. He then radioed the captain responding on rescue 1 requesting him to assume Incident Command (IC) upon arrival. The victim and firefighter #1 donned their self-contained breathing apparatus (SCBA) and made entry into the structure to search for the fire with a 44/mm handline.

The pump operator arrived in his POV at approximately 0713 hours without any bunker gear and was wearing the headset from E1 that only picks up the fireground channel. The IC arrived on the scene at approximately 0714 hours, and saw the victim and firefighter #1 enter through the B-side man door inside the garage. The IC immediately radioed and told all responding units to switch from the dispatch channel to the fireground channel upon arrival. He then radioed Central Dispatch to request a second alarm.

Engine 2 arrived on the scene at approximately 0721 hours and the two firefighters were requested by the IC to force open the front door. The victim and firefighter #1 continued searching the interior of the tri-level residence for the seat of the fire as the conditions worsened. The IC radioed the interior crew to see if they needed positive

pressure ventilation (PPV). The victim replied that he did need ventilation and then radioed the pump operator regarding low water pressure that was quickly restored. The IC had crew members start a PPV fan in the interior door from the garage. The interior crew was experiencing difficulty managing the charged hoseline while searching between the different levels of the house. They reached the B-side wall of the family room inside the basement, but could not find the fire. The victim told Firefighter #1 the fire wasn't in the current room and took out his regulator to see if he could distinguish the location and cause of the fire by smell. The victim called the IC to request assistance with the handline at 0723 hours and 23 seconds. The victim made two more transmissions to the IC with the last one stating that "it smells like food burning on the stove" at 0723 hours and 53 seconds. The victim's radio was no longer operating on the fireground channel. It is unknown how his radio got turned back to the dispatch channel. It is evident during these transmissions that the victim did not have his regulator in and was not on air.

The victim put his regulator back in and told firefighter #1 to find the kitchen. The victim and firefighter #1 struggled to move the charged hoseline back up the stairs to the main level. They were searching the kitchen area for the fire when firefighter #1's low air alarm started sounding. The victim told firefighter #1 to exit through the front door and send someone else in to take his place. The crew from engine 2 had just opened the front door. Firefighter #1 exited and then assisted with replacing the PPV fan with one from engine 2. The first PPV fan was flooded and running sporadically from its position inside the garage. The replacement PPV fan was operating through the man door on the B-side wall of the garage. The IC ordered the windows by the front door to be ventilated to assist with horizontal ventilation.

Firefighter #2 entered the structure to assist the victim and the victim asked him to take out his regulator to see if he could distinguish what the smoke smell. Firefighter #2 told the victim he could not distinguish the smell and left his regulator in his facepiece. The victim proceeded to lead him in search of the fire. The crew went up the stairs to the second story without the hoseline searching for the fire. Within a couple of minutes, the victim's low air alarm started sounding.

Outside, in front of the structure, the homeowner approached the IC in the driveway and told him he thought the fire was in the furnace room. The IC sent two firefighters into the structure to find the furnace room. The crew went in through the garage and down the stairs into the basement searching for the furnace room without a handline. They made it approximately 1.8-2.4/m inside the family room with zero visibility. They could hear the fire in front of them and overhead with high heat conditions and were forced to exit. At approximately the same time, the victim and firefighter #2 became disoriented and could not find their way out of the structure. The victim called command at 0732 hours for assistance and reported that they were lost on the second floor. The victim called command two more times within a minute and gave a Mayday stating that they were lost, needed help, and ventilation. The victim made a final Mayday call at 0736 hours. The victim's calls were never heard by the IC because the victim was on the dispatch channel. Central Dispatch did not know the meaning or consequences of a Mayday. An off-duty firefighter, monitoring the dispatch channel, called Central Dispatch to ask if they understood the severity of the situation and to urge the dispatcher to inform the IC of the Mayday.

The victim became panicked and was yelling to firefighter #2 to get him out of the structure. The victim went to his knees and took out his regulator stating that he couldn't breathe. Firefighter #2 began "buddy breathing" with the victim who was becoming more frantic. The victim collapsed on to the floor and became unresponsive. Firefighter #2 made his way to a window at the front of the structure and busted it out in an attempt to signal someone on the outside. He then went back to find the victim, but became disoriented and low on air. Firefighter #2 heard the PPV fan and moved down the hallway towards the sound. He stumbled on the stairs and found his way back out of the structure.

The IC saw firefighter #2 break the second-floor bedroom window on the A-side of the structure and sensed the crew was lost. He ordered the structure to be evacuated and for a firefighter to put a ladder to the window. He then sent a crew inside to conduct a search, and ordered all of the windows to be broken to ventilate and possibly help the crew find their way out of the structure. The rescue crew entered the structure without any RIT gear, followed the hoseline, and found the abandoned nozzle on the first floor. No one on the fireground heard the evacuation order over the radio. The apparatus horns were not used to signal an evacuation.

Fire conditions became untenable after the floor in the living room area collapsed, which was above the seat of the fire in the basement. The rescue crew was forced to exit the structure due to the extensive fire conditions. Additional crew members operated a 64/mm handline from inside the front of the structure to knock down the fire before the search could resume. The victim was found at approximately 0758 hours in the bathroom of the master bedroom on his left side. His alarming PASS device was muffled due to him lying on top of it. His face piece was on, with his regulator unhooked. He was removed through the master bedroom window and was transported to a local hospital where he was

pronounced dead.

The cause of the fire was spontaneous combustion of oil-soaked rags in the basement of the new addition. A door between the old basement and the new was closed, preventing firefighters from seeing the initial fire area.

#### Cause of death

The medical examiner lists the cause of death as smoke and soot inhalation with a carboxyhemoglobin level of 22.7%.

#### Discussion

In another fire department, a similar outcome occurred as well when a firefighter was performing a search and became separated. The firefighter, who succumbed to his injuries on December 16, 2003, was found by firefighters with his PASS alarm "under him". A recent law suit filed, claims it either did not function-or functioned poorly. One backup is needed to be able to count on is a PASS alarm and while they have done a good job in protecting firefighters, maybe it is time for the manufacturers to consider a redesign so they are:

- More reliable so the false activations are less frequent.
- More water and fire resistant.
- Have multiple "sounding points" so if one does fall on one side, the other sounder alarm can be heard.
- Even louder alarms.

It is known intimately about the radio signal systems, the GPS systems and all the other good stuff that many fine manufacturers are working on to help firefighters out in the future. But between now and then, maybe, just maybe the SCBA folks can simply and quickly start making the SCBA built in PASS alarms louder, more durable and with 2 points of sound. Until then, maybe firefighters dust off the old PASS devices from the back room of the firehouse. The old PASS alarms firefighters stopped using when the new integrated PASS alarms came with the new SCBAs, and clip the old ones on the opposite side of the SCBAs to create another manual backup.

There are always other steps that lead to firefighter deaths and injuries-no matter what. And there is always an "initial" series of failures leading to the tragic outcome. When the initial plans for survival fail (training, staffing, water on the fire, command, control, strategies, tactics etc), firefighters must be able to count on the "what if" backup stuff to help get us home.

#### Lessons learned (recommendations)

Recommendation #1: Fire departments should enforce standard operating procedures (SOPs) for structural firefighting, including the use of self-contained breathing apparatus (SCBA), ventilation, and radio communications.

According to the International Fire Service Training Association (IFSTA), firefighters should never be inside a working structure fire with anything less than full protective clothing, SCBA, and a PASS device. . ." because of the possible presence of toxic products of combustion. Reactions to CO poisoning vary with individual and include headache, vertigo, difficulty breathing, confusion convulsions, and coma.

Ventilation and radio communications are also is critical for firefighter safety on the fire ground. Correct ventilation releases heat and gasses from the structure and improves firefighter visibility. Two way communications must be maintained on the fireground to assist the IC in making tactical decisions base on information relayed from crew members or requests such as for ventilation. The department in this incident has SOPs regarding ventilation and communication procedures, and an SOP stating that SCBAs must be worn at all times while operating inside a structure on fire. Fire departments should conduct frequent training to ensure knowledge and compliance with their existing SOPs.

Recommendation #2: Fire departments should ensure that the Incident Commander completes a size-up of the incident and continuously evaluates the risk versus benefit when determining whether the operation will be offensive or defensive.

Discussion: One of the most important size-up duties of the first-in officer is locating the fire and determining its severity. This information lays the foundation for the entire operation. A proper size-up begins from the moment the alarm is received, and it continues until the fire is under control. Several factors must be evaluated in conducting the size-up, for example, type of structure and construction, time of day, contents of the structure, and potential hazards. In recent years, thermal imaging cameras (TICs) have been used more frequently by the fire service for exterior size-up to locate the source as well as the hottest part of the fire and for search and rescue to locate victims. This knowledge may help firefighters determine the safest approach and areas of the structure to avoid.

The size-up must include continued assessment of risk versus benefit during incident operations. According to NFPA 1500 §A-6-2.1.1, "The acceptable level of risk is directly related to the potential to save lives or property. Where there is no potential to save

lives, the risk to fire department members must be evaluated in proportion to the ability to save property of value. As Dunn (1992, p.291) states "When no other person's life is in danger, the life of the firefighter has a higher priority than fire containment."

The fire department met with the owner upon arrival and was informed that the structure was unoccupied at the time of this incident. A complete walk-around size-up could possibly have identified the fire location through the ground-level windows at the room of origin.

Recommendation #3: Fire departments should ensure that adequate numbers of staff are available to immediately respond to emergency incidents.

Discussion: For "low-hazard occupancies" (e.g., 1-, 2-, or 3- family dwellings), the NFPA recommends the following initial attack response: "At least two pumpers, 1 ladder truck (or combination apparatus with equivalent capabilities), 1 chief officer, and other specialized apparatus as may be needed or available; not fewer than 12 firefighters and 1 chief officer (p. 10-34)."

NFPA 1710 § 5.2.2 recommends that a minimum acceptable fire company staffing level should be four members responding on or arriving with each engine and each ladder company responding to this type of low-hazard fire. NFPA 1710 §5.2.1.1 states the following: "On-duty fire suppression personnel shall be comprised of the numbers necessary for fire-fighting performance relative to the expected fire-fighting conditions. These numbers shall be determined through task analyses that take the following factors into consideration:

1. Life hazard to the populace protected
2. Provisions of safe and effective fire-fighting performance conditions for the firefighters
3. Potential property loss
4. Nature, configuration, hazards, and internal protection of the properties involved
5. Types of fireground tactics and evolutions employed as standard procedure, type of apparatus used, and results expected to be obtained at the fire scene."

Recommendation #4 : Fire departments should use defensive fire fighting tactics when adequate apparatus and equipment for offensive operations are not available.

Discussion: A trend in the fire service is that some smaller, combination and volunteer fire companies are adopting the aggressive fire fighting tactics of larger, career departments. Some of these smaller fire departments do not have the training, equipment and back-up personnel to safely accomplish these dangerous tactics. In this incident, an interior attack was initiated with the only two firefighters with bunker gear on the scene. Operations should remain defensive until adequate resources arrive to assure interior firefighter safety.

Recommendation #5: Fire departments should ensure that ventilation is closely coordinated with the fire attack.

Discussion: Chapter 10 of the Essentials of Fire Fighting, 4th edition, states that "ventilation must be closely coordinated with fire attack." To reduce vertical extension, direct ventilation of the basement during fire attack is necessary. This can be accomplished in several ways. Horizontal ventilation can be employed to vent heat, smoke, and gases through wall openings such as doors and windows, even if the windows are below ground-level in wells. Natural pathways such as stairways can also be used to vent the basement area provided the means used to ventilate the heat and smoke do not place other portions of the building in danger. As a last resort, the basement can be vented by cutting a hole in the floor near a ground-level opening such as a door or window. The heat and smoke can then be drawn from the basement through the exterior opening using mechanical ventilation such as a smoke ejector. Forced ventilation, or positive pressure, introduces air at such great volumes that it can cause the fire to intensify or spread. Horizontal ventilation does not release the heat and smoke directly above the fire; therefore, it is imperative that horizontal ventilation is coordinated with the interior attack crew to ensure that it doesn't block their escape routes.

Recommendation #6: Fire departments should ensure that team continuity is maintained during fire suppression operations.

Discussion: Firefighters should always work and remain in teams whenever they are operating in a hazardous environment. Team continuity relies on knowing your team members and the team leader, maintaining visual contact (if visibility is low, teams must stay within touch or voice distance of each other), communicating needs and observations to the team leader, rotating to rehabilitation, staging as a team, and watching team members (practicing a strong buddy system). To maintain team continuity, firefighters working in teams should enter and exit the structure together.

Recommendation #7 : Fire departments should ensure those firefighters who enter hazardous areas, e.g., burning or suspected unsafe structures, are equipped with two-way

communications with Incident Command.

The fireground communications process combines electronic communication equipment, a set of standard operating procedures, and the fire personnel who will use the equipment. To be effective, the communications network must integrate the equipment and procedures with the dynamic situation at the incident site, especially in terms of the human factors affecting its use. Fire departments should review both operating procedures and human factors issues to determine the ease of use of radio equipment on the fireground to ensure that firefighters consistently monitor radio transmissions from the IC and respond to radio calls. After standard operating procedures are developed, fire departments must train everyone on their use. In this incident, the victim's radio was somehow switched to the wrong channel. If the other firefighters had been equipped with a portable radio, they possibly could have determined that the victim's radio was not on the correct channel. This could have helped to maintain communication with the IC and assist with rescue efforts.

Recommendation #8: Fire departments should instruct firefighters on the hazards of exposure to products of combustion such as carbon monoxide (CO) and warn them never to remove their face pieces in areas in which such products are likely to exist.

Discussion: The toxicity of CO varies with the length of exposure, the concentration, breathing and heart rate, and the physical condition of the victim. Depending on the concentration, a single unprotected breath of an Immediately Dangerous to Life and Health (IDLH) atmosphere (e.g., products of combustion) may be enough to cause incapacitation. During this incident, the victim removed his regulator for 1-2/minutes in an attempt to locate the origin of the fire by smelling the smoke. The actions the victim made after removing his regulator (i.e. not exiting with his partner, searching without a hoseline) suggests that his decision making may have been affected by breathing in the products of combustion.

Recommendation #9: Fire departments should ensure that a Rapid Intervention Team is in place before conditions become unsafe.

Discussion: A Rapid Intervention Team (RIT) should be positioned to respond to every fire. The team should report to the officer in command and remain at the command post or a designated area until an intervention is required to rescue a firefighter(s). The RIT should have all the tools necessary to complete the job, e.g., a search rope, first-aid kit, and a resuscitator. The RIT team should be comprised of fresh, well-rested firefighters, and be positioned and ready to respond when a firefighter(s) is down or in trouble. Initially in this incident, there weren't enough equipped personnel to provide for a RIT when the victim and the firefighter made entry as the IC arrived. When it was realized the victim was still inside the structure, firefighters were chosen from other duties to conduct searches without any RIT equipment.

Recommendation #10: Fire departments should use guidelines/ropes securely attached to permanent objects and/or a bright, narrow-beamed light at all entry portals to a structure to guide firefighters during emergency egress.

Discussion: When a structure is filled with smoke and visibility is poor, especially in large open areas or when there are maze-like conditions, firefighters can become disoriented or lost, and thus, in need of a guideline to escape. For an engine crew, usually this guide is the hose line. For a search crew, it could be a hose from an engine crew or a guide rope. Another strategy is to use guide ropes securely attached to permanent objects outside of the structure or to place a person and/or a bright light at the entry portal as a guide. Illuminated search lines/ropes for fire fighting operations also are available. Once these procedures are developed and outlined in SOPs, training in their use should be conducted on a regular basis.

Recommendation #11: Fire departments should use evacuation signals when command personnel decide that all firefighters should be evacuated from a burning building or other hazardous area.

Evacuation signals are used when command personnel decide that all firefighters should immediately be evacuated from a burning building or other hazardous area because conditions have deteriorated beyond the point of reasonable safety. All firefighters should be familiar with their department's method of sounding an evacuation signal. There are several ways this communication can be done. The most common method is to (1) broadcast a radio message ordering all firefighters to evacuate, AND (2) sound an audible warning device (air horn) on the apparatus at the fire scene for an extended period of time. The message should be broadcast several times to make sure everyone hears it. Whenever communications or a key tactical operation cannot be completed that places the interior crew at a severe risk (i.e. ventilation), the structure should be evacuated.

Recommendations #12 : Fire departments should train firefighters on actions to take while waiting to be rescued if they become lost or trapped inside a structure.

Discussion: Firefighters must act promptly when they become lost, disoriented, injured, low on air, or trapped. First, they must transmit a distress signal while they still have the capability and sufficient air. The next step is to manually activate their PASS device. To conserve air while waiting to be rescued, firefighters should try to stay calm and avoid unnecessary physical activity. If not in immediate danger, they should remain in one place to help rescuers locate them. They should survey their surroundings to get their bearings and determine potential escape routes, and stay in radio contact with Incident Command and rescuers. Additionally, firefighters can attract attention by maximizing the sound of their PASS device (e.g., by pointing it up in an open direction), pointing their flashlight toward the ceiling or moving it around, and using a tool to make tapping noises. A crew member who initiates a Mayday call for another person should quickly try to communicate with the missing member via radio and, if unsuccessful, initiate a Mayday providing relevant information as described above. At the time of the Mayday, the victim's radio was not on the fireground channel.

Recommendation #13: Municipalities should establish dispatch centers that are integrated with fire response functions.

Discussion: An effective dispatch system is a key factor in fire department operations. The central dispatch center is used for receiving notification of emergencies, alerting personnel and equipment, coordinating the activities of the units engaged in emergency incidents, and providing non-emergency communications for the coordinating fire departments. The dispatch system must be able to identify the type and number of units due to respond to the type of incident in advance based on risk criteria and unit capabilities. Because there were not pre-determined alarm assignments for specific situations and mutual aid, or an "alarm card," for the units dispatched, the Incident Commander had to decide which units and departments he wanted to respond to the incident. Having a pre-determined response for apparatus arranged by district, address, or type of incident, makes the Incident Commander's and the dispatcher's job much easier. The assignment lists the apparatus slated to respond to the incident and should take into account apparatus that are out of service by filling in for such units with similar units.

Central Dispatch should be staffed with operators who are familiar and trained with fire department operations and equipment. Central Dispatch could then also monitor fireground activity and inform command of time intervals and of possible missed transmissions, such as Maydays. A central dispatch center equipped with regional mutual aid channels could serve multiple jurisdictions. This type of system would provide operational advantages in the communication system, reflect a more functional mutual aid system, and reduce overall costs of operating centers in individual jurisdictions.

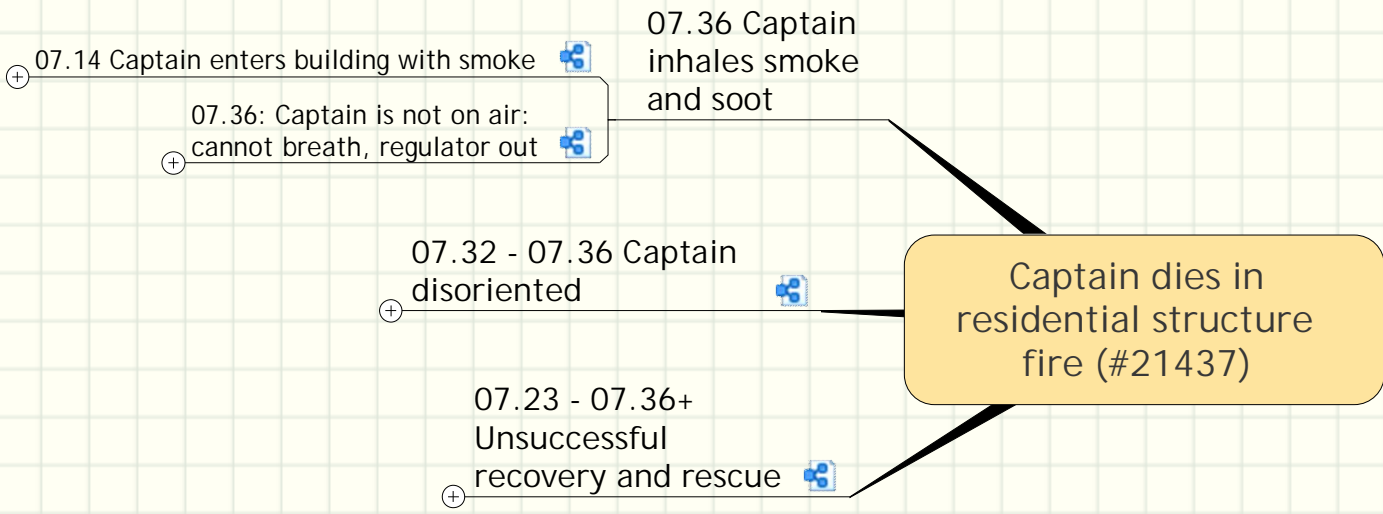
In this incident, the victim ended up on the dispatch channel when he radioed a Mayday. The IC was calling Central Dispatch to request additional manpower from specific mutual aid companies when Central Dispatch told him that an ambulance was paged for his Mayday.

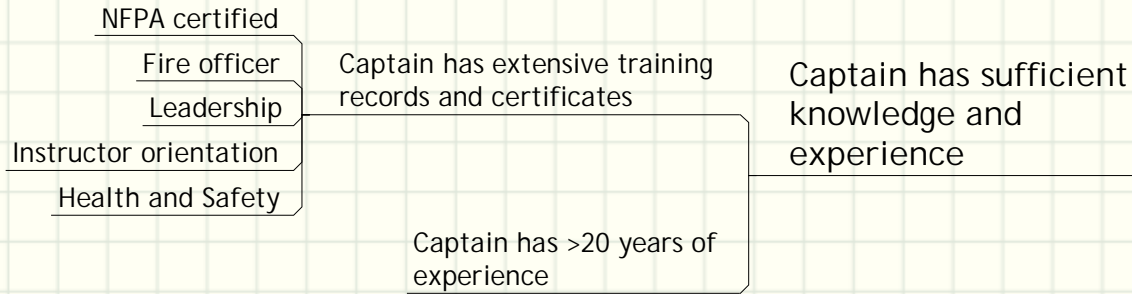
# Achilles

Hoe kun je ongevalsinformatie  
goed analyseren?

**ACHILLES #21437**

1





2

Fire fighting team absolutely unaware of source, location and spread of smoke

*What does the procedure say about entering a building without having any idea about the source, location and spread of the smoke and fire?*

What to do in case of smoke and fire

*Adequate standard operating procedures available?*

Fire fighting team absolutely certain about the absence of people inside the building

*What does the procedure say about situations in which it is absolutely clear that there are no people in the building?*

What to do in case of people inside

07.14 Captain enters building with smoke

Captain was in building with Fire Fighter #1 and did send him away, staying behind alone

+

Captain left the hose line behind when struggling with it

+

Captain took out the regulator at a number of occasions while being in the building

+

*Captain's typical application of procedures and rules in this case?*

3

07.23 Captain on air

07.32 Low air alarm

*Technical failure causing reduced time between low air alarm and actual loss of air?*

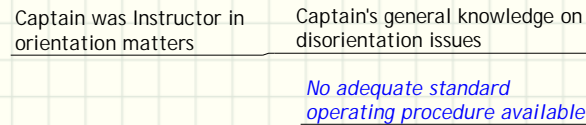
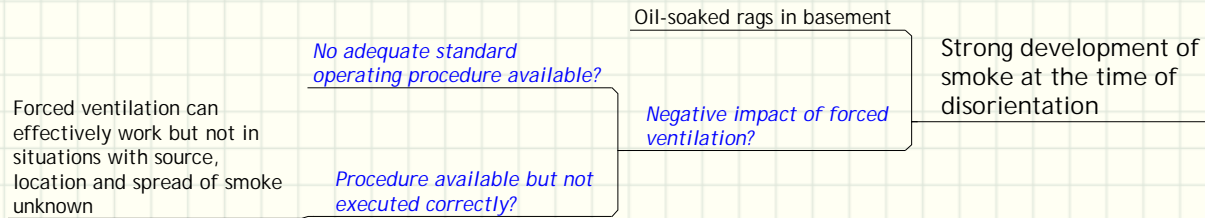
*No standard operating procedures available on how to respond on low air alarm?*

*Other?*

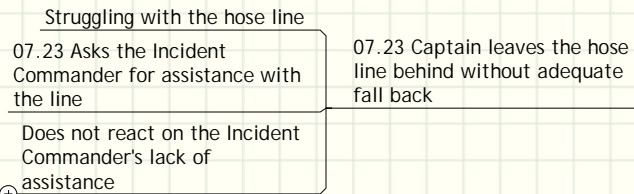
07.32 - 07.36 Captain does not respond on low air alarm

07.36 Captain is not on air: cannot breath, regulator out

07.36 Loss of air

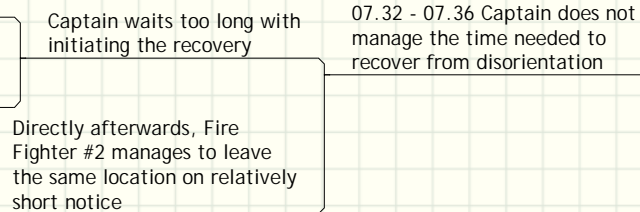


07.14 - 07.36 Captain does not take precautions on missing knowledge of the source, location and spreading of smoke and fire



0732 - 07.36 Captain does not respond adequately after calling for assistance, being lost with Fire Fighter #2 at 2nd floor

07.36 At the time of Mayday, recovery is physically impossible

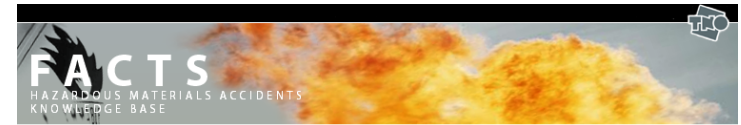


4

07.32 - 07.36  
Captain disoriented



# Meer weten?



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## Achilles