

**Exploratory investigation**  
**Fire with fatal outcome in De Punt**

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## Introduction

Three firemen were killed during fire-fighting operations at an industrial building on May 9 2008 in De Punt in the Netherlands. Anne Kregel, Raymond Soyer and Egbert Ubels attempted to reach the heart of the fire via an inside fire attack when they were caught unawares by a sudden spread of fire. It took approximately three quarters of an hour before colleagues were able to reach them. By then, the three were already deceased.

It is obvious that several authorities have made enquiries to investigate an accident of this nature.

For all due care required, each of the investigations will take much time. However, for the benefit of the relatives, colleagues and the municipality, a first and prompt insight in the facts of the case is desirable. The more so, since this first insight will enable both the municipality and the fire services in the Netherlands to quickly learn from this accident. As a result, the Municipal Executive of the municipality of Tynaarlo, De Punt is a municipal district of Tynaarlo, has requested the Nederlandse Vereniging voor Brandweezorg en Rampenbestrijding (Dutch association for fire service and disaster relief) to form an independent Committee of enquiry. The Committee will rapidly give a first insight into the possible fire cause, the fire behaviour in connection with the deployment of emergency services, and into the efficiency of the required training and drill for controlling this type of fire.'

The present report contains the conclusions from the Committee of Enquiry as reported to the Municipal commissioning authority.

Firstly, the Committee of enquiry wishes to thank all those that were prepared to talk to the Committee members. This was especially difficult for the direct colleagues. Furthermore, we owe a lot to the municipal 'Coordinating Group Enquiry fire accident De Punt' under presidency of Ike Kortleven. Information has been forwarded to us from various sources. We wish to thank all those that have contributed to the reconstruction of the accident.

A rather valuable contribution was made by the members of the 'feedback group', formed for the occasion: René Hagen (Lector fire prevention NIFV), Peter den Oudsten (Mayor of the city of Enschede), Cees de Raadt (Expert fire development and insulating material) and Astrid Scholtens (lector crisis control NIFV and Police academy).

Finally, the Committee of enquiry wishes to express its appreciation for the flexible collaboration with the Labour Inspection, the State's Council Office, the Inspection Public Policy and Security and the Dutch Safety Board.

This technical report is based on the information collected by the Committee of Enquiry as until 14 June 2008. As stated before, the report focuses on the learning aspect stemming from the fire in De Punt. Hence, it is not to be considered as an audit from the fire service from Tynaarlo or the regional fire service from Drenthe.

*Bookmark anchor:*

After the introduction, please find a management summary stating the conclusions and recommendations mentioned in this report.

## Exploratory investigation into the fire in De Punt, the Netherlands

The first chapter contains information concerning the fire cause and the first development of the fire up to the moment of arrival of the first unit of the fire service.

The second chapter explains the first fire fighting operations covering the period from alarm message to the first fire service unit up to the fatal moment of the sudden spread of fire. As a result, the events narrated in chapter one and two show a certain overlap in time.

The third chapter goes into the deployment of firemen from the moment of the sudden spread of fire up to recovery of the perished firemen.

The first three chapters contain a reconstruction of the events based on the tapes from the control room, interviews with those involved (see annex 2) and photos and videos. The times stated are accurate to the second and based on the tapes from the control room Drenthe.

Finally, the fourth chapter goes into the fire fighting preparations of the fire service from Tynaarlo.

In each chapter, you will find the opinions of the Committee of Enquiry placed inside an easily recognizable frame.

At the end of the report, you will find a 'summary', in which the events are summed up and the main conclusions and recommendations are stated.

## Management summary

### Overview of conclusions and recommendations

#### *A: Conclusions concerning the cause and spread of the fire*

- The Committee of enquiry refrains from giving an opinion on the exact fire cause.
- The sandwich panels used for the roof construction meet the legal requirements for this type of building with regard to the flammability en/or fire development. However, they do bring a huge danger: when heated the polyurethane will fumigate, which may lead to an unexpected and quick spread of fire. Although the dangers of sandwich constructions have been previously acknowledged during fire hazard testing and fire practice, they are not known throughout the fire service.
- Upon arrival of the first fire service unit from Eelde at approximately 2:18 PM, the fire at the backside of the boatshed had developed to the extent that the polyurethane sandwich roof panels were already heavily fumigating.  
The Committee of enquiry deems it plausible that, at that time, the ceiling had already been covered by a layer of smoke and fumes. Upon ignition of that layer a sudden spread of fire will occur, producing an enormous blast wave.
- It is assumed that during the first few minutes the polyurethane from the roof construction delivered the main fuel for the fire. After a short period, during which mainly the polyurethane was burning, several objects stored inside the boatshed, such as the aforementioned caravans and polyester boats, caught fire. At that stage, the fire had become more or less "unextinguishable": an inside fire attack was no longer an option and directing water from the outside would only affect the burning objects on one side.

#### *B: Conclusions concerning the fire service operations*

- The Committee of enquiry deems it likely that the smoke layer on the ceiling was not sufficiently hot to be detected by the thermal image camera from the first fire service unit, thus no alarming image was displayed. The heat of the lighting fittings may have had an interfering effect. On a similarly warm day, both ceiling and walls may have been warm anyway, thus limiting the vision contrast. Furthermore, from the entrance, the overhead door may have further limited visibility.
- The Committee of enquiry considers the decision making as a group to enter the building as one of the main questions risen from the accident. In scientific literature, a lot has been written about decision making by experts when under time pressure. In principle, the defensive outside fire attack will only be opted for in the event of a clearly controllable (hence a blaze) fire or in an otherwise evidently unsafe situation. As a result, firemen are trained to opt for the inside fire attack, unless there is clear evidence of the situation being dangerous. It is only in similar cases that the defensive approach is opted for.
- Moreover, with regard to the situation posed by the fire on 9th May 2008 in De Punt, the Committee of enquiry also concluded that virtually all firemen would have acted in the same way, and would have therefore walked into a deadly trap.
- The sudden battery exhaustion of the officer-in-charge's walkie-talkie, still functioning properly when tested, may be due to a "memory effect" of the batteries. However, the Committee of enquiry sees no reason to assume a scenario during which four out of six walkie-talkies would suddenly break down.
- The facts clearly show that it was impossible to save the trapped firemen: their oxygen had expired before sufficient material to rescue them had arrived on the scene.

- The Committee of enquiry questions the observation of a number of firemen that a glimpse of one of the colleagues had been caught. However, the symptoms of apathy described by the observers are consistent with those of body overheating.
- In the hectic of the moment, the Officers-in-charge involved have tried their utmost and have taken more responsibilities than may have been expected of them, but they lacked a good insight in the fire situation, which developed in a contra-intuitive manner.
- The Committee of enquiry concludes that the execution of the rescue and recovery attempts were insufficiently coordinated. The main reasons for this being the absence of a proper and proven procedure for 'own personnel missing' and the fact that fire officers are not selected, trained nor drilled to make a difference as "fire safety engineering manager" in similar situations.

*C: Conclusions concerning procedures, training and drilling*

- The policy for appointing and training of men and Officers-in-charge from Tynaarlo is in line with the national standards. According to the Committee of enquiry, special attention should be drawn to the policy concerning officers; many municipalities, nationwide lack a strict selection and assessment system at this level. However, officers meet the training requirements that apply to this end.
- The drilling policy of the municipality of Tynaarlo and that of the regional fire service Drenthe is in line with the national standards. The drilling activity concerning the basic fire fighting operations is sufficient, even more so when the additional regional activities are taken into account.
- The Committee of enquiry questions the current offering of so-called flash-over trainings. Like the (subject) material, they suggest that an inside fire attack can be safely deployed when there is no clear evidence of heat accumulation inside a room.
- The recent definition of a regional 'heat' risk-inventory and evaluation, required by the Dutch Arbo-legislation, is in conformity with the national developments. And in line with the national trend, most attention is being paid to deviating incident types, such as accidents with dangerous substances. However, by far most casualties occur during 'regular' fire fighting operations.
- Over the past years, Tynaarlo has invested in new safety measures, such as sound equipment emitting a signal when a firemen is no longer moving. Furthermore, the municipality has invested in flash-over training and in-service training 'safety during repressive action'. By doing so, the municipality is following the national trend.
- The local and regional fire service do not yet dispose of a proven procedure 'own personnel missing'. The current version, based on 'withdraw, count men and summon assistance' proved to be insufficient to face a situation like that on May 9 in De Punt.
- The Committee of enquiry questions the nationally used emergency procedures for own personnel.

*D: Recommendations for de Dutch Fire service, including the fire service from Tynaarlo and regional fire service from Drenthe*

Recommendations concerning the deployment of the inside fire attack:

- Fires inside industrial buildings should always be approached by the fire service in a defensive manner.
- When exploring the defensive approach, the installed insulating material should always be taken into account in the danger aspects of the scene.

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- The Dutch fire service should adjust its deployment procedures accordingly.
- We stress the fact that during drilling en fire service competitions more experience should be acquired in the field of defensive operations after arrival at a fire site representing unknown risks.
- Develop and implement a nationally applied procedure 'own personnel missing'.

### Recommendations concerning training, drill and exercise:

- Choose between either a strict observance of the national deployment procedure (6 men per TS), or take during training and drills reality into account, i.e. seven or eight firemen per fire engine instead of the 6 men as stated in the national deployment procedure.
- Likewise, the reality of uncoordinated participation of men arriving later, should either be exercised or forbidden.
- Pair the exercises with a form of quality assessment, in order to enable systematic feedback. Especially at the officers-in-charge and officers' level, a system allowing some kind of assessment should be put into place.

### *E: Specific recommendations for the fire service in Tynaarlo and/or regional fire service Drenthe*

- Subject the preventive maintenance policy for batteries and walkie-talkies of municipalities and the region to further investigation.
- Select officers on the basis of their competence and accentuate fire safety engineering aspects of the drill for officers.

Summarizing, the Committee of enquiry states that the fatal fire in De Punt on 9<sup>th</sup> May 2008 imposes upon the Dutch fire service the task to reinvest and continuously invest in its key task, i.e. firetechnical professional skills. After all, in this case we cannot speak of 'risk of the trade', but of an avoidable incident. The Committee of enquiry is of the opinion that the fire officers involved are not to blame; they acted grosso modo according to the existing procedures and were unaware of the risk involved.

Therefore, the Committee of enquiry states that it is necessary to invest in fire technical expertise, in the adjusting of the procedures, training documentation, and exercising based on these adaptations.

## Chapter 1

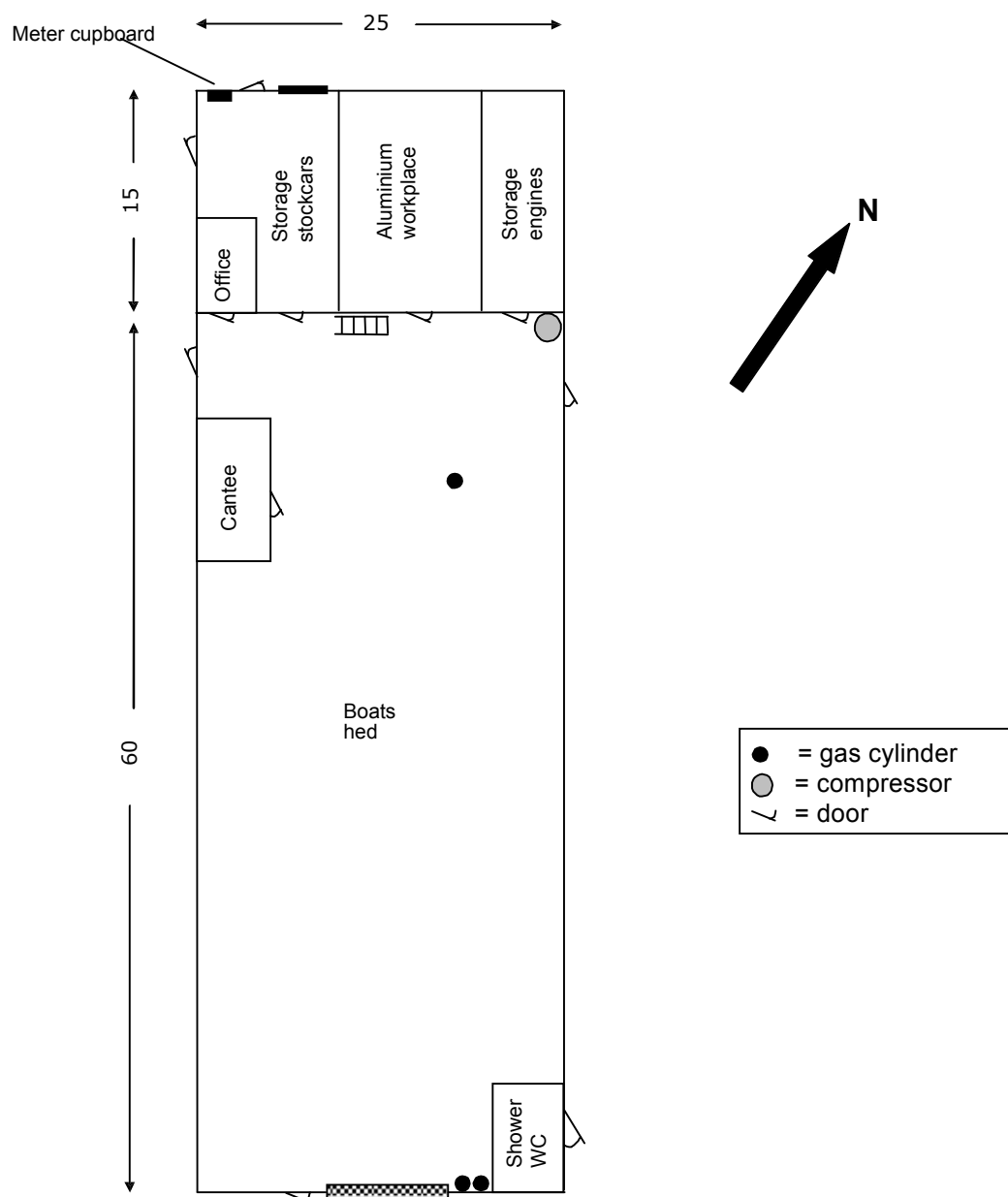
### Fire cause and fire development until arrival of first fire unit

This chapter contains an explanation of the cause of the fire and the way the fire had developed prior to the arrival of the first fire unit.

In order to explain the cause of the fire, a description of the building (interior) is required. See description below.

#### **Building**

The building in question is located at the Groningerstraatweg 118 in De Punt, the Netherlands, and is used as a boatshed and/or repair shop for pleasure boats. The boatshed is 25 metres wide and 75 metres long (see figure 1).



**Figure 1:** Ground plan of the boatshed located in the Groningerstraat 118 in De Punt.

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The boatshed was divided into several walled-in spaces. The relevant spaces are included in figure 1. At the back of the building, there were three separate spaces of each 15 metres deep, to be used for several activities: The space (seen from the front) to the left is 10 metres wide, consisted of an small office, followed by a storage and equipped with its own sliding door. This space was also used for repair work on (stock) cars. Furthermore, on the back wall of this room a meter cupboard and a gas meter were located. The aluminium workplace, also 10 metres wide, was located in the middle of the boatshed and was used for manufacturing porthole frames out of aluminium strips. The smaller space on the right was 5 metres wide and used for the storage of engines. Each of the spaces, including the small office, had its own entrance giving access to the rest of the building (the boatshed).

The three separate rooms were divided by a wall from brick building blocks. Simultaneously, the ceiling of the three spaces served as the flooring of the attic, which was made out of wood. The ceiling of the three spaces was equipped with electric cable conduits, mounted with a 220 Volt and a 380 Volt power supply.

The attic run up to the three spaces in the back and did not cover the entire boatshed's length. The attic was accessible via an open staircase, located in front of the space in the middle. The attic was used a storage room and had an open connection to the rest of the building (the boatshed). In other words, there was no partition wall between the storage room upstairs and the boatshed.

The front of the boatshed was equipped with a large overhead door (8 metre wide), which completely shoves up when being opened (so no slide door). When fully opened the door becomes so to speak an additional lowered ceiling of 8 metres wide and 5 metres deep, viewed from the entrance. On both sides, the boatshed was equipped with windows (not shown in figure). Near the separate spaces, behind the boatshed, the boatshed was equipped with an entrance door at each side.

The boatshed was built around a supporting steel construction. The majority of the sidewalls were made of profile section plates. The lower one, at a distance of approximately 1.5 metre from the sidewalls, consisted of a small cavity wall.

The roof of the concerned building consisted over its total length of coated sandwich panels, made of two steel sheets (gauge 0.4-0.5 mm), filled up with insulating material of approx. 9 cm polyurethane foam (PUR). The roof had no light openings, such as (hinged) windows or transparent roofing sheets. As a result, electric lighting of the boatshed was always necessary. The lighting fittings inside the boatshed were fixed onto the roof sticks, which made it difficult to see the roof's ridge, since lighting beams were directed downward, as a result the space above the fittings was completely dark.

The building was equipped with an intruder alarm and a fire alarm installation, which was equipped with temperature sensors that were (amongst others) located in the workspaces. The control unit receiving fire alarms was located inside the boatshed owners' residence. The afore-mentioned residence, which also serves as a shop, was located on the site of the boatshed, at approximately 100 metres distance. Based on the official building regulations code, the installation of an intruder and fire alarm was not required, therefore it did not forward the alarm signal to the regional emergency centre.<sup>1</sup>



The building contains considerable amounts of inflammable material. Varying from inflammable carpets and spare parts for the stock cars worked on in the working spaces, up to gas cylinders and polyester boats inside the boatshed.

### ***Fire development and cause of fire<sup>2</sup>***

*Remark in advance:* Two days prior to the fatal fire on May 9, on Wednesday, a small fire broke out either inside or near the meter cupboard located in the workspace at the rear of the building. The fire was put out by the yard's personnel. On Friday, after having carried out reparations to amongst others the electrical installation, all the circuits are put back in operation. The owners have not investigated the exact cause of this fire.

On Friday afternoon May 9, a fire breaks out again inside or near the meter cupboard. A staff member of the yard attempts to put out the fire with a hand extinguisher aiming the extinguisher at the meter cupboard. However, he/she fails to fully extinguish the fire before the extinguisher is empty. A second hand extinguisher is found, however the amount of smoke and the heat inside the workspace makes it impossible to re-enter the space.

During the first extinguishing attempt, another member of staff goes to the residence of the owners, which is at approximately 100 metre distance from the boatshed, and raises the fire alarm. Subsequently, at 2.19 PM one of the owners calls the fire service. After this call, several boats from the boatshed had been secured.

De Committee of enquiry refrains from giving its opinion regarding the exact cause of the fire. The Committee of enquiry thinks that the fire could quickly develop inside the workspace due to the presence of considerable amounts of inflammable material, varying from inflammable carpet to spare parts used for repairing the stock cars. The gas meter was mounted next to the meter cupboard and may therefore quickly have caught fire. A sizzling sound, which has been perceived in the back by a policeman, prior to the arrival of the first fire unit, seems to backup this idea.

A cable duct ran from the meter cupboard straight up to the ceiling. The fire may therefore have spread to the storage attic within minutes, since the attic was openly connected to the rest of the hall and was filled with all sorts of inflammable material. As a result, one of the first sightings made by a fireman, driving past the building on his way to the fire station (approximately one minute prior to the arrival of the first unit from Eelde) read: a clearly hot spot at attic level, showing that parts of the paint on the outer wall had already started to peel.

As stated, the building's roof consisted of so-called sandwich panels.

For this type of building, this type of panel meets the safety requirements with regard to flammability and/or spreading of fire<sup>3</sup>, however they also represent a serious danger:

<sup>1</sup> Based on the building regulation, buildings with an elevated risk for occupants, may be designated to be equipped with a public alarm system (openbaar meldsysteem OMS). These systems automatically forward alerts to the regional control room.

<sup>2</sup> Unless otherwise stated, sources for information in this section stem from the depositions made by employees from the yard recorded by the police complemented with information from an interview between the Committee of enquiry and the owner and her daughter.

when heated, the polyurethane will start to fumigate, which means that inflammable and toxic fumes are being released. These fumes contain ammonia, hydrocyanic acid, and nitrous fumes. The nitrous fumes have a characteristic brownish-yellow colour. First, the fumes will give off along the edges of the panels, but will also accumulate inside the sandwich panels. The colour of the smoke coming out of the panels, as appears from fire testing, is white at first, than turns into a yellowish-brown colour. The polyurethane foam simultaneously serves as the 'glue' keeping both steel plates together and ensuring their rigidity. When heated, it will not take long before the foam becomes unstuck from the steel plates, which as a result are no longer connected. If one of the fume layers is sufficiently concentrated, a source of ignition may ignite them. In the event of polyurethane foam actually catching fire, it releases a greasy black smoke.

Approximately six minutes after raising the first fire alarm (14:14:58), the owner (female) calls the fire service again to make sure that the fire service unit is on its way. On being asked, she replied that the 'rear end is already on fire', a statement she made based on the smoke drifting out of the entire rear end of the building. So, at that very moment the fire had already taken on substantial proportions. The moment, at approximately 14:16, two policemen in a patrol car arrive onsite, they too observed that a substantial fire has rages across the entire width of the rear part of the building. At that moment, the fire was not yet breaking out.

When at approximately 14:17 the first fire service unit from Eelde, and the fire engine 3111 arrived at the roundabout next to the boatshed, they crew observed a heavy yellow-brown cloud of smoke coming out from the rear of the boatshed. Subsequently, the officer-in-charge reported at 14:17:40 to the control room that this is 'very bad smoke', requiring blocking off the road where it is blown over by the wind.

The Committee of enquiry concludes, based on the heavy smoke production coming from the rear of the boatshed, that when the first fire service unit from Eelde arrived at approximately 2:18 PM, the fire at the rear had already been developed to a stage where the polyurethane sandwich panels on the roof had already started to fumigate heavily. The wind blowing into the boatshed from the front, caused the yellow-brown fumes to be 'pushed out' through the chinks between the roof and the back wall. Since these fumes have a relatively low temperature, they remain low and float towards the airport as a heavy, compact cloud of yellow-brown smoke. By that time, the inflammable gasses had already filled up the upper part of the boatshed to such an extent that, should the flames reach the sufficiently concentrated gas-bearing layer, the gasses would ignite. As a result, the accelerating front of flames rolling from behind the boatshed towards the front may cause a heavy pressure wave.<sup>4</sup>

The dangers of similar sandwich constructions have been sighted during prior fire tests and fire drills. For instance, the Committee of enquiry has been given photo's stemming from a fire from 1995 in Montfoort, showing a sudden fire acceleration in an *empty* storage boatshed, built with polyurethane sandwich panels, as stated by those involved. Video-footage of experiments carried out by for instance the BRE, also shows that both the fumigation when heated and the sudden accelerated spread of fire when the gasses are ignited.

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<sup>3</sup> At least according to the usual interpretation of small scale fire tests executed to determine the fire category.

<sup>4</sup> A similar pressure effect is called deflagration. Deflagration also occurs in spaces containing a lot of dust and they are therefore called dust explosions.

The Committee of enquiry states that in the event of a fire inside industrial buildings the great danger of a sudden spread of fire and the absence of the urgency for rescue should be taken into account:

- The majority of industrial buildings is equipped with insulating (sandwich) panels with an inflammable insulating polystyrene or polyurethane<sup>5</sup> layer. Prior to the fire service arriving onsite, a considerable amount of time will have passed making the possibility of a sudden (explosive) spread of fire caused by insulating material a realistic one.
- Taking into account the Arbowet, the assumption should further be that the in-house emergency service has already cleared the concerned industrial building, thus rescinding the necessity for rescue.

As a result, the Committee of enquiry recommends based on the available knowledge that any fire raging inside industrial buildings should always be approached by the fire service in a defensive way.

To further assess deployment when using the defensive approach, it is necessary to explicitly examine what type of insulating material has been used.

The Committee of enquiry summons the Dutch fire service, and the fire service Tynaarlo to adjust the deployment procedures accordingly.

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<sup>5</sup> Sandwich panels are by the way also used in residential and non-residential building for roof and elevation constructions.

## Chapter 2

### Deployment of fire service, fire development from first alarm message received by the fire service unit until the sudden spread of fire.

*Weather conditions on 9th May 14.00 hours: sunny day, temperature of approximately 25°C and a moderately blowing wind at 3 Bft<sup>6</sup> South-East turning to East. The wind direction was partially directed towards the front of the boatshed, and inside via the open overhead door.*

Alarm message sent by owner is received by the regional control room of the regional fire service Groningen<sup>7</sup> at 14:09:00. At 14:09:36<sup>8</sup> the message is forwarded to the regional control room of the regional fire service Drenthe under which Eelde resorts, as a message: 'fire in meter cupboard in industrial building'.

At 14:10:01 hours, the members of the volunteer fire service from Eelde are alerted via their pagers with the message 'house fire'. In conformity with the procedure, the Duty officer from the fire service is also alerted. Furthermore, the police (unit 1022) are going to the site.

At 14:14:32 hours the fire engine from Eelde, the TS 3111 is complete and turns out. At the time there are seven men onboard, i.e. one more than the national standard occupation of six men.

*Intermezzo.*

*Standard crew of six firemen per fire engine has a standardized division of tasks as described in the nationally applicable learning material.*

*The name fire engine implicates a vehicle equipped with its own water tank.*

*This enables feeding of the high-pressure pump. The high-pressure hose or high-pressure sprayer is a relatively thin and flexible hose that can be unreeled from a reel, and is used for the fighting of smaller fires. Commonly used lengths are 60 and 90 metre. In the event of a fire requiring larger water quantities, the pump is used to supply water via the hydrants connected to the water distribution system or by sucking it up from open water. In the event of larger fires, the fire service will deploy thicker so-called low-pressure hoses. A limited number of this type of hose is reeled up onboard of the vehicle. After arrival they need to be unreeled and connected. After arrival, the driver switches to being the fire engine's pump operator. The so-called 'numbers 1 and 2' form the attack team that carry out together the initial rescue or examination or fight the fire. If, to this end, they have to enter a building, they will take the high-pressure hose with them for their own safety, unless the urge of the rescue does not allow for this.*

*The so-called 'numbers 3 and 4' form the water team, ensuring the 'water supply', i.e. connecting the fire engine to an underground hydrant or to open water. In the event of the attack team having entered a building without hose for urgency reasons, the water team will have to cover the retreat of the attack team by means of (high-pressure) hose..*

<sup>6</sup> Wind force 3 on the scale of Beaufort means a 10-minute average wind speed of 12- 19 km/hour. Wind force 3 blows up dust and sets leaves and twigs in motion.

<sup>7</sup> De Punt's area code '050'; 112-alerts are therefore received in the control room Groningen. The Committee of enquiry deems this situation undesirable for it cause additional time loss. By the time the planned 'Noordelijke meldkamer' is actually realised, the situation will be solved.

<sup>8</sup> Time corresponding to that on the tapes of the control room Drenthe, the time in the time registration of the control room Groningen is 14:09:32.

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*The officer-in-charge is in charge of the fire engine. He is responsible for the decisions concerning the deployment of the fire engine if this is the only equipment present, and for the execution of the decisions made by the Duty officer if present.*

*The Duty officer from the fire service is alerted in cases at which either deployment of several fire services is required – in such an event he is responsible for the coordinated deployment of the fire fighting service units – or in the event of alignment with other services being required.*

The Duty officer from the TS 3111 immediately afterwards contacts the control room, information is given that this is not a house fire, but a fire inside a meter cupboard of an industrial building probably 'at Beuving's'. For the crew of the 3111 this message contains a lot of implicit information that is now being discussed on the way to the scene: firstly, they link this incident to the small fire two days earlier, and subsequently position the fire inside the boat boatshed instead of inside Beuving's shop. Several members of the crew know the concerned boat boatshed well. One member of the crew goes there regularly to repair the stock cars in the workplace where the meter cupboard is located. The dangerous gas cylinders, the presence of all sorts of inflammable liquids and the fire danger the boats partially made off polyester inside the boatshed represent, were all explicitly named.

The atmosphere inside the vehicle is of a positively tense, this is a real fire, and this occurs very seldom. The men have been trained for years, exercise on a weekly basis and now is the time to put it all into practice.

With reference to the second phone call from owner at 14:14:58 and another message, control room further informs the approaching TS 3111 and Duty officer at 14:15:35 that 'the entire backside would be on fire'.

At 14:16:25 hours, the police unit 1022 reports on the scene. The personnel informs the two police officers that there is no one left in the boatshed and they each part investigating one side of the boatshed. One of them stays at the front and talks to some employees. He glances inside the boatshed and remembers that he got a good sighting of the position of the boats, however in the back of the boatshed towards the ceiling he observes a kind of smoke cloud. The other officer explores the boatshed on the canal side and observes through the window at the back a, at the time still inside the building, raging flash fire that has already caused the ceiling above the workplace at the *right* rear to collapse. The wall plates in the back wall are hot. At 14:17:21 he reports to the police control room 'blaze' and immediately after that 'gas cylinders'.<sup>9</sup>

At 14:16:44 hours control room sends another message to the scene concerning the underground hydrant on the cycle path alongside the road, and repeats that they 'receive several messages and that it would involve a blaze'. The latter is not yet the case, as the Officer-in-charge observes when catching a first sight of the building the very same moment. There is however a heavy yellow-brownish smoke drifting calmly away over the road towards the airport.<sup>10</sup> For the crew of the TS 3111 this smoke pattern did not resemble anything they had ever seen before in a fire: enormous amounts of smoke of a colour unknown to hem – too much for a small fire, - however the smoke did not 'lift', i.e. the smoke remains low above the ground, - which is unusual for a large fire -.

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<sup>9</sup> On 7 June 2008, another witness has stepped forward who drove by on May 9, saw the smoke on the outside and went to take a look inside the boatshed out of curiosity. Due to the time of the report and the requirement of this witness for complete anonymity, the Committee of enquiry has not been able to talk to this witness, and has transferred this task to the Dutch Safety Board.

<sup>10</sup> The smoke was so heavy, that the air traffic at the air port was suspended for a short period.

Based on this observation the officer-in-charge changes this during that same conversation into 'middle fire', meaning according to the regional procedure that assistance from an additional fire engine and a hydraulic arm s requested.<sup>11</sup> The crew of the TS 3111 is unanimously for scaling-up. One of the crew members remembered later that at the time he thought 'this is not a fire for just one fire engine'.

After the TS 3111 has made a U-turn and had arrived upwind in front of the boatshed at approximately 14:18, the situation looks completely different: when standing directly in front of the boatshed, and looking through the rolled open overhead door there is no smoke to be seen, only a cloud of yellowish smoke at the extreme rear of the boatshed. The Officer-in-charge can only just manage to sight the staircase in the back of the boatshed. At that moment, it looks like the smoke does only occupy the width of the spaces in the back of the boatshed.

The Committee of enquiry deems it plausible that in the hall underneath the ceiling a layer of smoke and fumes must have been present. However, since the roof had no transparent panels of something of the sort, sighting was difficult for the firemen. The wind blowing at full speed into the boatshed will have further resulted in good visibility straight ahead, but also to an accumulation of smoke and fumes against the back wall and the roof. However, standing at the entrance the ceiling is hardly visible since the overhead door of 8 metres wide and 5 metres high was opened moving inside, i.e. a 8 metres wide and 5 metres deep 'board' has been rolled indoors.

In addition, immediately after their arrival the firemen had contact with the scene exploring police officer. He tells them that there are definitely no people inside the building and that there is a car on fire at the back.<sup>12</sup>

Among the firemen now raises the idea that the fire is not that serious after all. What they see at the front of the boatshed does not correspond with their ideas based on the observations when approaching the building. They now picture a covered car fire inside the building that they should be able to put out. The control line seemed obvious: the left route on the outside towards the back of the building is obstructed by various boats and a ditch for construction runs through it. To the right on the outside is an obscure narrow route running between the boatshed and the waterfront, however, straight ahead there is an open route through the middle of the boatshed. The car fire will therefore be attacked using a high-pressure hose that will be transported through the boatshed. This 'control plan' is the result of a short discussion involving the majority of the crew, during which the Officer-in-charge and the 'number 1', and a professional fireman who is highly appreciated for his expertise<sup>13</sup> within the brigade take a leading role. The formal command from the Officer-in-charge 'Investigate and extinguish any potential heart of fire! I will carry out the exploring outside.' is the procedure. As safety measure, the Officer-in-charge gives order to take a thermal image camera. Since he does not wish to split up the crews, the entire water team enters the building.

<sup>11</sup> Message middle fire means that the station Vries is alerted and the hydraulic platform from Assen is driven in. Control room operator suggests when talking to Duty officer that the foam tender from Assen should be brought, in order to supply the hydraulic platform, since the entire team from Assen is being summoned. Duty officer agrees.

<sup>12</sup> The policeman involved does not clearly remember this event. He only remembers that he reported the gas cylinders.

<sup>13</sup> Number 1 was ranked junior chief fireman and served therefore as officer-in-charge when pulling out, as het arrived first at the station Eelde after having received the alarm message.

The Committee of enquiry considers that the decision of the group to enter the building is one of the main questions raised by the accident. How is it possible that within only a few minutes the opinion of the crew from TS 3111 has shifted from 'dangerous unknown fire situation necessitating scaling-up to a middle fire' to a 'obviously controllable fire situation that we can put out with an inside fire attack'?

The answer to this question lies according to the Committee of enquiry in the scientific literature concerning decision-making by experts when under pressure.<sup>14</sup> At the heart of the research is the assumption that experts under time pressure based on their experience and a number of factors opt for the usual option. Afterwards, quietly sat behind a desk comments may be given on the decisions made, the truth remains however that experts are a product of their experience. For the fire service, this means that they are mainly a product of exercise and, in the case of the voluntary fire service, of fire service competitions. All exercise and competition part from the ideal of an arrival at an object followed by an inside fire attack. The defensive outside fire attack will only be opted for when the fire is clearly out of control (in practice this translates into a blaze) or when the situation is otherwise unsafe (for instance when dangerous substances are present). Firemen are trained to always execute an inside fire attack unless clear signals are being observed that this is not safe. Only then will they proceed in a defensive manner.

In this case the consequence is that the crew of TS 3111 whilst standing in front of the boatshed starts as it were from scratch again. Their approach being the inside fire attack was based on the usual attack method, in line with the indications of 'little smoke and heat', on a starting fire inside an object. Since the officer-in-charge deemed it necessary to bring a thermal image camera as a safety measure, the decision was taken to slightly adjust the regular deployment procedure<sup>15</sup> by sending along the entire water team. At the time, he knew (see below) that he had sufficient 'additional' men to ensure the water supply.

In annex 3 you will find a detailed consideration with regard to this mechanism, as well as a number of complementary theories that explain the ignoring of deviating signals. It is the Committee of enquiry's opinion that with regard to the situation posed by the fire on 9th May 2008 in De Punt, virtually all firemen would have acted in the same way, and would have therefore walked into a deadly trap

The Committee of enquiry concludes that is necessary to acquire experience during exercise and fire service competitions in the field of defensive operation after arrival at a fire that represents unknown risks. The deployment procedures should support this by instructing to always initially opt for the defensive approach until sufficient fire service potential has arrived onsite allowing, after thorough exploration of the site and with a stand-by team at hand, to carry out an inside fire attack.

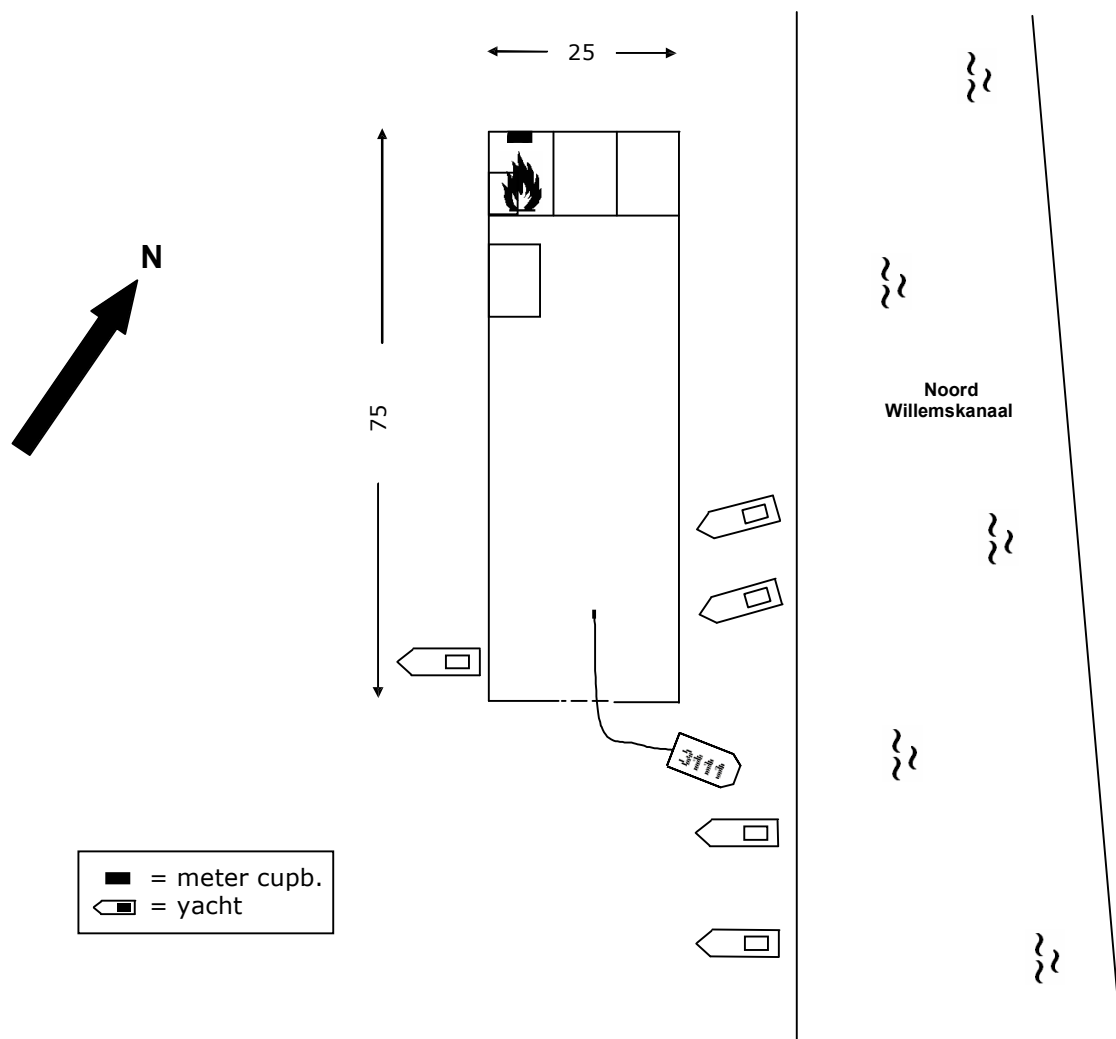
<sup>14</sup> See I. Helsloot, E.J. Oomes and A.C.J Scholtens, *Veiligheid bij repressief brandweeroptreden in Brandweer, studies over organisatie, functioneren en omgeving*, I. Helsloot, E.M. Muller and J.D. Berghuijs, Kluwer, 2007 for an overview.

<sup>15</sup> See intermezzo on page 9.

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The attack team and water team thus take the 90 metres long high-pressure hose with them inside the building and proceed to the rear of the boatshed. The driver/pump operator, the 'seventh man' and a member of the brigade not in uniform, who had arrived separately, ensure the water supply and operate the pump. Apart from that, it was known that the second unit AS 3131 from Eelde was to follow and if necessary take care of the water supply. The Officer-in-charge had observed that when TS 3111 left the station, two crewmembers of the AS 3131 were already present.<sup>16</sup>

Number 1 switches on the thermal image camera that he takes from the TS 3111, and carries it inside the building. There are no witnesses that can confirm its use; however, number 1 is described as someone who was very keen on the proper use of the thermal image camera during inside fire attacks.



**Figure 2:** Situation shortly before sudden spread of fire (approx. 14.20 hours).

<sup>16</sup> Fire engine AS 3131 is a van for carrying people and material equipped with a front-mounted pump. Hence the AS 3111 does not dispose off a water tank, requiring it to always connect to a hydrant or open water. The AS 3131 is not an official vehicle, it will always arrive later for extra assistance to the TS 3111.



The Committee of enquiry deems it plausible that the smoke layer against the ceiling was not sufficiently hot for the thermal image camera to detect, or to display a disturbing image. The heat from the lighting fittings may have had an interfering effect. On a warm day like this, the ceiling and walls may have probably already been warm, which would have limited the contrast beforehand. Furthermore, the overhead door will have limited the view even more.

The Officer-in-charge intends to explore from the right, which is the normal procedure. After approx. 15 metres, the high-pressure hose becomes snagged. One of the firemen turns around and walks back to the exit to release the hose.

Outside the field of vision of the firemen, at the front of the boatshed, during the approx. 2 or 3 minutes that have passed since the TS 3111 drove over the roundabout, the pattern of the fire at the rear has deteriorated dramatically: a black plume of smoke is being forced out of the ridge of the roof, and yellow-brownish smoke is billowing out from the edges of the roof. This incites a colleague from the fire service Vries, who passes by the boatshed, to call the control room and request scaling-up of the fire to a middle fire, the very moment he receives the message 'middle fire' on his pager.

The firemen in action only notice this further development of the fire when it is already too late. A blast wave blows the fireman busy releasing the high-pressure hose off his feet, parts of the opened sliding door collapses around the fireman, and a column of fire and pitch-black smoke is forced out of the boatshed through the door opening.<sup>17</sup> The fireman in the door opening crawls a few metres to safety on his hands and knees; the other three firemen are left behind in the building in the inferno that suddenly engulfs the entire hall.

Both the Officer-in-charge, who at the moment of the sudden spread of fire had just completed 10 metres of his exploring the outside, and the escaped fireman try to establish radio contact with the three. They will keep doing so, and so will others, however without establishing contact.

The battery of the officer-in-charge's walkie-talkie was suddenly exhausted. For this reason, the officer-in-charge almost immediately takes the walkie-talkie from the nearby standing driver/pump operator.

In the opinion of the Committee of enquiry, the suddenly becoming exhausted of the officer-in-charge's battery, while it was properly functioning when tested, could be caused by the 'memory effect' of batteries.<sup>18</sup> A recurring question during interviews was if the trapped firemen may have had malfunctioning walkie-talkies. During these interviews, several incidents in the region concerning the reliability of walkie-talkies were put forward. However, the Committee of enquiry sees no reason to assume a scenario in which four out of six walkie-talkies suddenly break down. We do however consider it desirable that preventive maintenance for batteries and walkie-talkies is further looked into in the light of the reported incidents.<sup>19</sup>

<sup>17</sup> Owner and her daughter, standing in a straight line to the overhead door of the shop building, report a pressure wave 'making the windows chink'.

<sup>18</sup> Rechargeable batteries that are always placed in the charger have reduced battery life (operating time). To prevent this, the battery should from time to time be completely discharged.

## Exploratory investigation into the fire in De Punt, the Netherlands

Within seconds, the heat is terrible. Along the entire roof edge, white burning smoke is being forced outside outside. Furthermore, the fire causes a terrible noise, probably caused by the sandwich panels that start to move and collapse. A few seconds later, the entire door construction comes crashing down.

The Officer-in-charge from the TS 3111 reports at 14:21:41 to the control room that some of his personnel are missing and therefore requests scaling up to 'large fire'.<sup>20</sup>

<sup>19</sup> As part of this exploratory enquiry, no further research has been carried out on the walkie-talkies that were found at a later time

<sup>20</sup> The control room operator suggest to immediately scale up to a 'very large fire'. The officer-in-charge agrees.

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### Chapter 3

#### After the sudden spread of fire, rescue and recovery

After the sudden spread of fire, the first fire service unit from Eelde is reduced to four shaken firemen, hoping against all odds for a miracle to happen. By mutual agreement with the control room, the Officer-in-charge signals 'extremely large fire'.<sup>21</sup> With a second high-pressure hose, the fireman that had only just escaped tries to cool the first high-pressure hose from the TS 31111, in order to enable the trapped firemen to use it should they manage to get to it.<sup>22</sup> Until the moment of recovery, the driver/pump operator will continue to keep the first high-pressure hose under pressure, which heavily reduces the performance of the low-pressure. However, the high-pressure hose has not been used again.

Shortly after the sudden spread of fire at approximately 14:22, the second unit from Eelde, the AS 3131, with three more men onboard arrives on the scene. The AS 3131 is not an official turnout vehicle, but always follows the TS 3111 in order to provide with additional assistance.

The firemen try with all their might to protect the high-pressure hose that is still located inside the burning space. Via the windows, they tried to cool in the direction where they assumed their colleagues were. To do this, they had to organize the optimal extractions of water from the canal, install the hoses and a manifold, and arrange the supply from the first engine. All this took time. An extra danger is presented by an acetylene cylinder inside a rack to the right of the entrance that has been blowing for approximately 10 minutes. This produces so much heat that a hole is being burnt in the outside wall causing the TS 3111, despite its protection by a water screen, to suffer light fire damage.

On the photographs made during this period, it shows that the intensity of the fire initially described as an inferno with fireballs inside the pitch-black plume of smoke coming out of the opening at the front of the boatshed, decreases after a few minutes. For a very short while the visibility inside the boatshed even returns. After that, the intensity of the fire increases again and thick black smoke is coming out of the front again. Through the windows on the left front, the flames of a caravan on fire are now visible. As a result, a boat on the outside also catches fire..

The Committee of enquiry concludes that during the first minutes the polyurethane from the roof construction was the main fuel for the fire. This is also visible in the fire situation, for over the entire length of the boatshed, on top of the flanks, the coating has evaporated. After a short period, during which mainly the panels containing polyurethane are burning, objects inside the boatshed, like the afore-mentioned caravan and polyester boats are catching fire. By then, the fire has become 'inextinguishable': it is no longer possible to carry out an inside fire attack and from the outside burning objects will only be hit from one side.

At approximately 14:26, when the intensity of the fire is increasing again, the fire engine from Vries arrives. The 'rescue plan' remains the same: to direct the largest quantity of water possible through the door opening in order to lower the temperature and by means of the air-sucking effect of the jets of water obtain some degree of vision in the pitch-black plumes of smoke.

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<sup>21</sup> Scaling up to a very large fire means that units from Zuidlaren, Peize, Norg, Vledder, Rolde and Veenhuizen, as well as additional executive officers are alerted. The region Groningen is nearby and the TS Haren and SB Groningen are therefore alerted.

<sup>22</sup>

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For this, the unit from Vries installs a water canon into place that directs water through the door opening.

Shortly after the unit from Vries, the Duty officer arrives on the scene. He has followed the message exchange via his radiophone on his way to the site. He has given the order to scale up to GRIP 1.<sup>23</sup> Shortly after his arrival, he summons the assistance of measuring teams because of the heavy smoke.

At 14:28 the Officer-in-charge from the unit from Vries informs the control room that it is 'burning hot, two men from Eelde are missing and that additional material is required'.<sup>24</sup> The control room operator suggests to alert an additional fire platoon, being platoon 200. The Officer-in-charge agrees to this for he already understands that even the requested capacity for 'very large fire' will be insufficient to fight the fire and rescue the victimized firemen.

At 14:29, the airport Eelde offers to send one of its crash tenders. The control room accepts the offer.<sup>25</sup>

It is around this time, approximately 10 minutes after the sudden spread of fire that, according to the reading out later of the breathing equipment, the oxygen supply for the trapped firemen expired so that they died from asphyxiation. It is likely that at the time at least two of the firemen were already unconscious due to the excess heat, trying to find an exit across the pitch-black boatshed, while being disorientated. They have not tried to disconnect their masks nor their breathing apparatus. The third fireman probably disconnected his breathing apparatus and became unconscious as a result of carbon monoxide poisoning, before dying.

In the opinion of the Committee of enquiry, the facts clearly state that there was no way of rescuing the trapped firemen: their breathing air had expired before adequate equipment could be brought to the scene to rescue them.

Disorientation seems probable, considering the fact that they have been found in three different parts of the boatshed. It seems likely that they, similar to number 2, have been blown off their feet by the blast wave caused by the sudden spread of fire and due to disorientation were unable to relocate the high-pressure hose. It was virtually impossible to find the exit in the clouds of pitch-black smoke.

What's more, it was hottest at the front, which has led them not to move into that direction at all.

Two colleague firemen from Eelde stated to have caught a glimpse of one of the trapped fireman staggering nearby the window they were hosing into.

<sup>23</sup> GRIP 1 is a Multi-disciplinary coordination level, at which the executive officers from the three emergency services coordinate their actions. Announcing a GRIP means that from each of the three services, one executive officer is summoned and that the commander swap body, a mobile meeting room, is called onsite. By the way, the police had already announced a GRIP 1.

<sup>24</sup> The idea of two instead of three people missing catches on for a while, for everyone assumes that 'only' the attack team has entered the building.

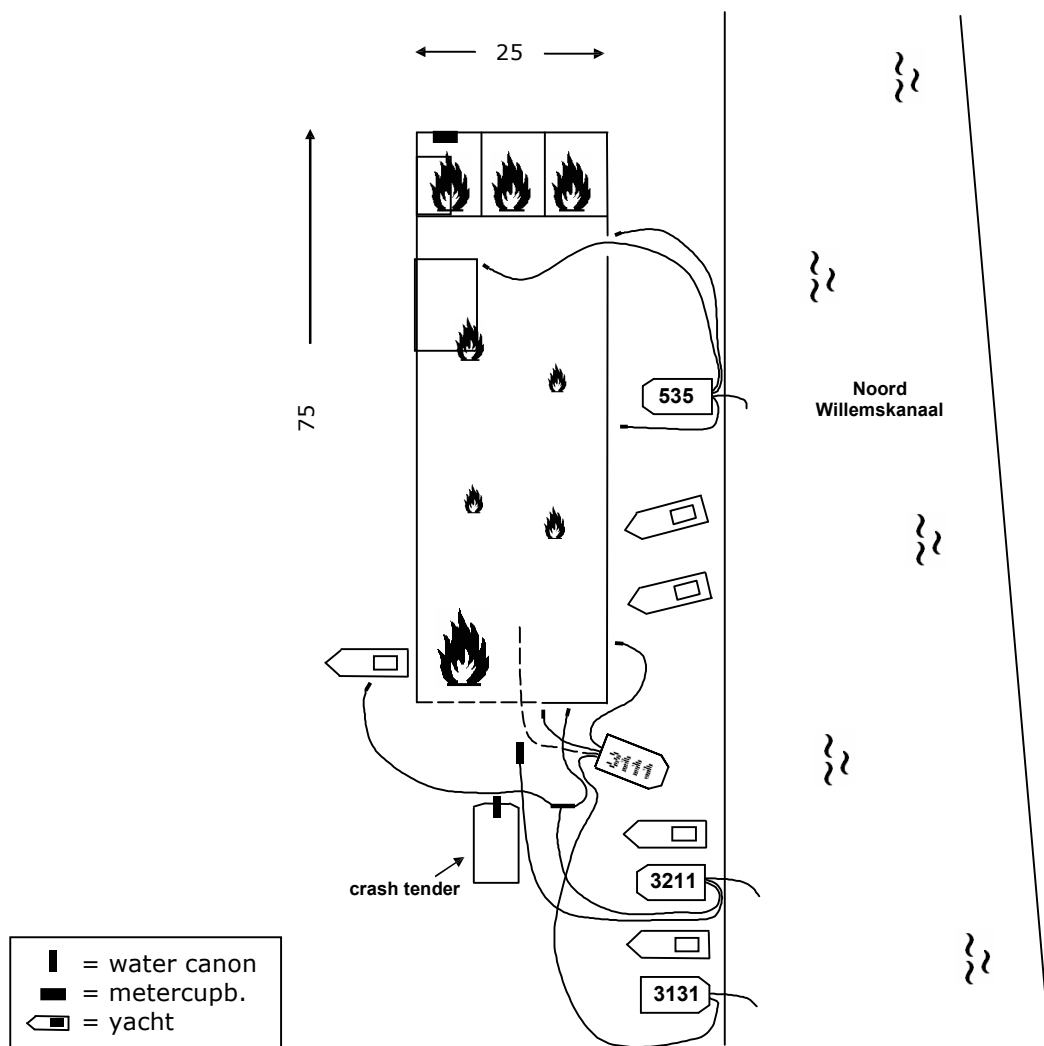
<sup>25</sup> Initially, the control room operator gives the crash tender 'prio 2'. When a few moments later, at 14:33 the Duty officer 'asks for as many water canons as possible', he suggests the Duty officer to still give the crash tender 'prio 1'. However, by then the crash tender has already arrived on the site.

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Subsequently, they were unsuccessful in trying to catch his attention and were unable to reach him through the window. They have not immediately communicated this observation. Therefore, no further action has been taken during this stage of the investigation.

Operations prior to the moment of observation also carried out by observers (connect to open water by AS 3131, connecting AS 3131 to TS 3111, connecting manifold on TS 3111 for boatshed and connecting low-pressure to cool down waterside of boatshed) seem, also based on the video-footage showing mainly confusion in the first phase, to have taken more time than ten minutes. This gives the Committee of enquiry reason to question the observation. The symptoms of apathy however, as described by the observers, are consistent with the image of an overheated body.

During the few minutes after 14:33, more material arrives simultaneously on the scene: the foam tenders from Assen and Groningen, the crash tender from Eelde, the hydraulic platform from Assen and the fire engine from Haren (535).



**Figure 3:** Situation layout at approx. 2.40 PM.

The fire engine from Haren (535) is given the orders by the Duty officer to operate at the back of the building<sup>26</sup> The 535 takes however a different entrance and positions itself on the waterside of the boatshed, covered by a water canon (see below).

The first unit deployed is the crash tender from the airport Eelde. Its massive spurt of water, that hit the lower part of the roof, had a noticeable effect on the fire, as stated by several witnesses. The air-sucking effect of the spurt of water creates a slight visibility inside the boatshed. Later in addition to the crash tender, the water canon from the foam tender from Groningen is also deployed, which is being supplied by the TS 3211 from Vries.

The 535's officer-in-charge explores part of the boatshed with his attack team, probably shortly after the deployment of the crash tender however unaware of this fact, via the back door on the waterfront.<sup>27</sup> He observes several smaller hearts of fire, that does not explain the enormous heat they have observed on the outside. Covered by the water team that is standby in the door with a low-pressure hose, they search for the missing firemen amidst the objects covered with a thick layer of black soot. At first, their search is unsuccessful, causing them to retreat. During next contact with the Duty officer, the latter forbids them to make another attempt because of the ongoing danger for the personnel deployed.

The Duty officer has also indicated that no operations are to be carried out yet at the front of building. In the first period after the sudden spread of fire, this seems evidently impossible. At a later stage, the deployment possibilities at the front are still hindered by the blaze caused by a caravan located to the left of the entrance. As soon as a group of Officers-in-charge estimates that the circumstances at the front allow for operations, the decision is made to carry out a new inside fire attack inside the partially collapsed boatshed to recover the perished firemen. Subsequently, the boatshed is being searched on all sides and the victims were recovered in less than 15 minutes.

The Committee of enquiry concludes that the rescue and recovery attempts were insufficiently focused and were lacking in coordination.

There are several reasons for this.

- The local and regional fire service does not yet dispose off an adequate and proven procedure 'own personnel missing'. The current version is based on 'withdraw, count men and request for assistance' is evidently inadequate in situations like the one on May 9.
- The involved officer-in-charges have tried their utmost, despite the hectic, and have often taken on more responsibilities than may be expected of them, but they lacked proper insight in the fire situation that developed in a counter-intuitive way; an inexplicable inferno during the first minutes on the outside and after that a moderate fire situation inside the boatshed.
- The Duty officer had not been selected, trained nor drilled to make a difference in a similar situation as 'fire safety engineering manager' (see also chapter 4). The term 'fire ~~safety engineering manager~~' implies a robust manager that is capable of effectively guide the deployment

<sup>26</sup> Communication between the 535 from the region of Groningen and the Duty officer from Drenthe is hindered because of the fact that the walkie-talkies from the two regions cannot be switched to the C2000 group of the other regions.

<sup>27</sup> Deployment of the 535 while the crash tender was trying to extinguish the fire, would have entailed a serious danger for the crew.

of several fire service units, i.e. with an understanding of the relation between the fire service operations and the fire development. This observation is not unique to the fire in De Punt; they have also been made during evaluation of previous fatal accidents, such as the fire in the Koningskerk in Haarlem in 2003.

As a result, the Committee of enquiry recommends the Dutch fire service to lay down an adequate procedure 'own personnel missing' and the municipality of Tynaarlo to implement this procedure. Furthermore, the Committee of enquiry recommends the municipality of Tynaarlo and the regional fire service from Drenthe to select Officers based on their competences and to concentrate during exercise on the fire safety engineering aspects.

In chapter 4 explaining the preparation, several of the afore-mentioned aspects are discussed.

## **Chapter 4**

### **Preparation for basic fire fighting**

Providing fire service is a municipal responsibility. To this end, the following system has been laid down in the Fire services act 1985: the local government is responsible for the fire service of the relevant municipality. To this end, the Municipal Executive organise the tasks, the organization and the management of the local fire service. Furthermore, the Municipal Executive is responsible for the realization of an (adequate) organisation of the local fire service. The obligation to provide fire service includes amongst others preventing, limiting and fighting of a fire as well as limiting the danger of fire. To this end, each municipality disposes off a fire service.

In addition, putting into place of a 'regional fire service' is a legal obligation; this comprises a collective arrangement between designed communities that need to realise several well-defined tasks, such as alerting and disinfecting the population in the event of accidents involving dangerous substances, as well a manning the municipal (regional) control room. The municipalities pay the regional fire service a fee based on their number of habitants.

In addition to tasks of the regional fire, services as imposed by the law, in order to ensure the local provision of fire service, the municipalities may outsource tasks to the regional fire service. The municipality of Tynaarlo and 11 other municipalities form the regional fire service Drenthe. De municipality of Tynaarlo was created 10 years ago from the three communities Eelde, Vries, and Zuidlaren. As a result, the local fire services have merged into the municipal fire service of Tynaarlo, with three volunteer pullout posts: Eelde, Vries, and Zuidlaren.

The legal obligation to provide fire service implicitly entails the responsibility to equip the firemen in such a way, that they are able to effectively and safely carry out the repressive fire service operations. This responsibility lies with the local government being the employer and is an explicit result from the Arbeidsomstandighedenwet 1998 (short: Arbowet 1998 = working conditions act). It stipulates that the actions of the fire service personnel is to be laid down in procedures, fire service personnel is to receive adequate training (trained and drilled) and the basis for these procedures and instructions should consist of a risk inventory. The Working conditions act specifies the way these aspects should be shaped.

This chapter will view how the municipal fire service from Tynaarlo has taken the required organizational measures to enable safe and effective fire service operations. After all, the quality of the performance by the deployed units during the fire in De Punt is for the larger part determined by these organizational measures. In this case, it is about education, training and in-service training (warm) risk inventory and evaluation and the degree in which the fire service personnel can rely on (for this investigation relevant) procedures, accessibility maps and control plans. With regard to these subjects, we will only discuss the organizational measures that are relevant for the regular fire fighting by men, Officers-in-charge, and Duty officers.

The documents submitted by the municipality of Tynaarlo and the regional fire service Drenthe, as well as the interviews with the regional coordinator for training and drill, the senior fire officer of the fire service from Tynaarlo and the Fire officer of the station Eelde have served as input for this chapter.



### ***Training***

The Netherlands has a legally binding system for training requirements, specified in the Resolution for fire service personnel: for each rank there is precisely defined training material, which is laid down in terms of examination requirements.<sup>28</sup> For the purpose of training there is national training material is made available, edited by the Nederlands Instituut Fysieke Veiligheid (Dutch Institute for Physical Safety), a monopolist in this field. Examinations are centrally assessed by the Nederlands Bureau Brandweereexamens (Dutch office for fire examinations, NBBE), an independent body attached to the Dutch Home Office.

Within the municipality of Tynaarlo, the pullout crew is appointed by the Municipal Executive. Based on the instructions of the fire officer of the municipal fire service, it is determined what rank the personnel is given and promotions are discussed. Requirement being that all staff meets the requirements as stated in the Resolution for fire service personnel.

The pullout crew of the fire service Tynaarlo meets the nationally applied training requirements, as stated in the Resolution for fire service personnel.

A complementary rule in Tynaarlo is that one may only start the training to become officer-in-charge (followed by a possible appointment later) after having been subjected to the selection procedure consisting of a group evaluation and a psychological test.

Surprisingly enough, there is no specific selection procedure or competence assessment test for Duty officers. Duty officers are registered in a regional register, used by municipalities to authorize the Duty officer to operate in the relevant municipality. Although a new officer policy, based on the idea of sufficient starting-out qualities and a positive starting-out assessment and professional checks when in function has been worked on for some time now, a (governmental) decision has not yet been made.

The Committee of enquiry deems the appointing and training policy for crew and officer-in-charges in Tynaarlo to be in conformity with the national standards. Point of special interest should be, however the policy for officers, both on a national and local scale this level lacks a strict selection and assessment system. However, officers meet the training requirements laid down to this end.

### ***Exercise, training, and in-service training***

Exercising is one of the key tasks of the fire service, since not all aspects of the fire fighting operations are sufficiently addressed in daily practice during fire fighting operations, to assume that all personnel is sufficiently capable in this field.<sup>29</sup> In Tynaarlo it is rule that the (voluntary) firemen from Eelde on average participate in two fires per year.

<sup>28</sup> This means a formal connection between ranks and training and not between function and training. In practice, rank and function are often linked by means of legal status regulations. It is however evident that the law (clause 8 Arboret 1998) that personnel in a certain function also has completed the education required for occupying that very function, however the direct legal link with the requirements from the Resolution fire service personnel is lifted.

<sup>29</sup> See also 'Beter oefenen bij de brandweer' (1999), Home Office.

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During these events, only the firemen that are 'coincidentally' present acquire experience. Acquiring experience during practice is only useful if the exercise is adequately evaluated, if not it may only lead to the creeping in of wrong mechanisms.

*Exercise policy plan:* As stated before, the Fire Services Act 1985 stipulates that the organisation, management, and operations of the municipal fire service are the responsibility of the Municipal Executive. Therefore, the Municipal Executive being the employer is bound to lay down the exercise policy plan specifying the expectations with regard to quality of their fire service personnel.

The Regional Fire Service from Drenthe has put into place an exercise policy plan for 2006-2009. Based on this plan, for each municipality, including Tynaarlo, strategic plans are drawn up. At the heart of the exercise, policy plan is meeting the standards specified in the Leidraad Oefenen (guidelines for exercise).

*Guidelines for Exercise:* the legal obligation to exercise fire service personnel (with the exception of the Brandweerwet 1985) is stipulated in the Arbowet that explicitly obliges employers to instruct<sup>30</sup> their personnel in an adequate manner. Labour inspection upholds this obligation. The branch guidelines are used as criterion. The so-called *Leidraad Oefenen* may be considered the branch guidelines that apply to fire services. So far, the Labour inspection was not successful in actively upholding the guidelines throughout the Fire service branch.

#### *Intermezzo*

*The Leidraad Oefenen is a practical tool meant to raise the exercise level of fire service personnel and keep it at a high level, thus guaranteeing the provided fire service quality. The guidelines consist of a number of exercise cards, divided in exercise cards for the overall basic tasks that each fire service needs to carry out (is supposed to) and cards for specialist tasks or material. Furthermore, the cards are sub-divided in different operational levels during fire fighting operations (crew, Officers-in-charge, and Duty officers). Per exercise subject, the cards provide a basic description of the exercise's objective and execution. They help to plan, carry out, evaluate, and register each of the exercises.*

*The Leidraad Oefenen was nationally distributed in 2000 by the Home Office. In 2007, the NVBR has issued a revised version. As a result, the Leidraad is a national guideline for exercises for the fire service. However, there is no legal obligation to use the Leidraad.*

In Tynaarlo the exercise, training and in-service training policy is based on the Leidraad Oefenen.<sup>31</sup> Exercise, training, and in-service training are divided in three different levels (station/municipality, district level, and regional level).

- Municipal level

Exercise with the exercise cards from the *Leidraad Oefenen* for crew and Officers-in-charge is organised at municipal level. Basis is approximately 40 weeks of exercise and one exercise per week. To this end, for several years now the municipality of Tynaarlo has a 0.5 fte exercise coordinator at its disposal. The coordinator plans the exercise and organises larger exercises (middle fire). Working through the exercise cards from the *Leidraad Oefenen* takes 1.5 year. To this end, 3-months cycles are scheduled. Within the 3-months cycles, there is also room for revision exercises, enabling to catch up with exercises one has missed due to circumstances.

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<sup>30</sup> Clause 8 of the Arbowet uses the words "effective information and instruction".

<sup>31</sup> From 1st January 2008 the revised version of the *Leidraad oefenen* is in use.

Execution of the exercises is the responsibility of the station officer. He is also responsible for the registration of the completed exercise level. Up until this year, only the presence during exercise nights was registered. From 1<sup>st</sup> January 2008, individual completion of the exercise card is registered. In 2007, on average 71% of the brigade members had attended each of the exercise nights. Since some of the exercise nights also offer revision possibilities, the percentage of completed exercise cards will be slightly higher. According to an estimate from the Fire officer from Eelde, 80% of the exercise cards in 2007 were completed. According to his estimate, during the main exercise with focus on fire fighting operations, nearly everyone was present.

Furthermore, fire services regularly exercise inside buildings within their service area. A recent exercise took place inside the boatsheds from the Beuving company.

Striking detail is however, that all exercise is carried out in conformity with the national deployment model, i.e. based on an occupation of six people per fire engine. However, in practice the volunteer fire service Tynaarlo can have eight men onboard of the fire engine, and a free intake of people later is possible. In fact, this means that the exercise is not practiced, as reality would require. This is not only the case for Tynaarlo, this situation applies to larger parts in the Netherlands.

- District and regional level

In addition to the exercise at station level, the regional fire service offers its men once a year an in-service training, such as flash-over trainings in Wijster. Beside these exercises, the majority of fire services in Drenthe participate in fire fighting competitions. Although it is currently possible to include competitions in the exercise records, the municipality of Tynaarlo chooses not to do so. As a result, each exercise and competition may be considered an addition to the competence. For the time being, in Tynaarlo they mainly register participation in exercise. As a result, of insufficient instructor capacity, an observation and feedback system on the quality has not been put into place yet.

Officers-in-charge participate in exercise at station level. Exercise for middle fire are organised at district level. Furthermore, they act as officer-in-charge in competition. In addition, Officers-in-charge are offered once a year an interregional in-service training, and twice a year an exercise day in Wijster at regional level. Flash over trainings are also exercised. Over the past years, all Officers-in-charge have completed an in-service training in Safety during repressive operation. Exercise for large scale operations are organised by the regional fire service. These are not integrated in the exercise night working with the Leidraad Oefenen. Over the past years, all the Officers-in-charge from Tynaarlo have actively participated in in-service training, exercise days, including the in-service training 'Safety during repressive operation'.

Duty officers exercise at district level when middle fire exercise is concerned, but they also exercise at station level is so required. Twice a year they complete at district level an exercise day, of which one consists of a virtual exercise. At regional level, once every two years, a practice week is organised in Sweden or England. By now, this event has taken place four times. This year, a pilot will be started to organise a realistic practice week in Valkenburg. The practice weeks are organised at an interregional level in collaboration with the NIFV (Dutch Institute for Physical Safety). On a regional level, officers participate in large-scale coordination exercises.

The Committee of enquiry deems the exercise policy of the municipality of Tynaarlo and the regional fire service Drenthe to be in conformity with the national standards. Over the past years, a part-time municipal exercise coordinator has been appointed.

In line with national practice, the exercise cycle from the Leidraad oefenen (from 2001) is completed in 1.5 years instead of one year. The revised version of the Leidraad oefenen (from 2007) represents a less heavy exercise load especially where secondary fire service tasks are concerned. The effort invested in exercise concerning basic fire fighting seems to be sufficient, especially when the additional regional activities are taken into account.

However, the Committee of enquiry recommends integration of reality in exercise, like seven or eight firemen per fire engine instead of six men as stipulated in the national deployment procedure. Strict compliance with the national deployment procedure is another option. With regard to what option to choose, the opinions within the sounding group for this enquiry were divided. It is the Committee's of enquiry unanimous opinion that in rural areas the advantages of additional capacity that is rapidly available outweighs the disadvantages of providing the officer-in-charge with more control. It should however be clear that under no circumstances more than two teams supervised by one officer-in-charge may carry out an inside fire attack.

Furthermore, the reality of free intake of people arriving later should be either exercised or forbidden. In Tynaarlo this was mainly the case for the later arrival of the AS 3131, that sometimes is deployed as an almost full second unit under supervision of an officer-in-charge and sometimes merely as a means of transportations for two members arriving later.

In addition, the Committee of enquiry recommends linking the exercise to a quality measuring system, allowing systematic feedback. Especially at the Officers-in-charge and officers level, a warm assessment system should be put into place.

Finally, the Committee of enquiry questions the current offering of so-called flash-over training. Generally speaking, this is a 'participative demonstration' during which the roll-over on the ceiling and the heat effect is experienced of the so-called 'hot-rich' flash-over inside a small confined space free of inflammable material. This may give the false impression that one can survive a flash-over by just bending over or by aiming the high-pressure jet towards the ceiling.

The currently available training documentation also gives a false image, for it states danger characteristics based on the characteristics of a hot-rich flash-over inside a small confined space, i.e. characteristics corresponding to a hot gas layer inside that space, such as door handles and small plumes of smoke coming from inflammable furniture.<sup>32</sup> The documentation suggests that if none of these characteristics are being observed, an inside fire attack may be safely deployed.

<sup>32</sup> Only the module men fire fighting operation shows a figure illustrating a 'cold' flash-over in Germany.

### ***Policy and procedures***

Policy and procedures are meant to support repressive operations. If they are not actually implemented, read exercised, they are not very useful.

### ***Risk inventory and evaluation***

Recently, and for the first time, a system with the focus on the risk inventory and evaluation ('warm RI&E') of repressive operation has been developed for all municipalities at a regional level. The system is based on the MARS method recommended by the Labour Inspection. The implementation plan of the recommendations from the warm RI&E is ready, however awaiting administrative approval.

The main points of interest from the RI&E relate to the knowledge concerning special incidents and procedures. As a result, fire fighting in 'common' industrial buildings is not mentioned.

### ***Procedures, accessibility maps, and control plans***

The municipality of Tynaarlo does not dispose off a specific accessibility map or deployment procedure for boatsheds, including the boatshed in De Punt.

### ***Emergency procedure 'own personnel missing'***

The Committee of enquiry has observed that the fire services from Drenthe lack emergency procedures 'own personnel missing' that are workable and have been exercised. The emergency procedure that is currently in use for wounded personnel 'withdraw, count men and summon assistance' does evidently not work in the event of personnel missing, due to the short time frame they have prior to oxygen cylinders will be empty.<sup>33</sup> This observation is not a new one: after fatal fires at the Motorkade in Amsterdam in 1995 and in Harderwijk in 1998 the observation had already been put forward.

An emergency procedure specifying that each fireman should now have a 'bodyguard'<sup>34</sup>, is ready, however awaiting implementation. In essence, this new emergency procedure stimulates communication with the supervisors concerning the observed emergency situations, and allows waiting for instructions from supervisors ('not at your own initiative' is what it says). However, the new emergency procedure is no lead for fire fighting situations like that on 9 May 2008 in De Punt.

The Committee of enquiry deems the recent drawing up of a 'warm RI&E' in line with the national developments. Nationally the focus is on deviating incident types, like incidents involving dangerous substances. However most victims are to be mourned for during 'regular' fire fighting operations.<sup>35</sup>

Over the past years, Tynaarlo has invested in new safety measures, such as sound emitting equipment if a fireman is no longer moving. Furthermore, they state

<sup>33</sup> This procedure is only known to Duty officers and Officers-in-charge.

<sup>34</sup> The 'bodyguard' gives instruction concerning the use of oxygen and emits a warning signal when carrier has not moved for several minutes.

<sup>35</sup> Although there is no data available on the relative frequency of accidents, the absolute frequency gives sufficient cause to look into incidents occurring during regular fire fighting operation and the exercise this requires.

to have invested in flash-over training and in-service training with focus on 'safety during repressive operation'. By doing so, the municipality is following the national trend.

It is the Committee of enquiry's opinion that, as mentioned before, the deployment procedure for industrial building should be reversed from 'inside fire attack unless...', to 'no inside fire attack unless...'. The Committee of enquiry sees therefore no need for drawing up special control plans.

The Committee of enquiry questions the usual emergency procedures for own personnel. Recent research in the United States has shown that the problem is much bigger than initially thought. The fire service in Phoenix found out that, when a fireman went missing in 2001 in a fire inside a large shopping mall, the existing procedure, that amongst others ordered the availability of two rescue teams of each two men, was insufficient. When trying to rescue the trapped fireman, 12 more colleagues got into trouble, but they did survive.<sup>36</sup>

This accident was cause for the fire service of Phoenix to have Professor Ron Perry from the university of Arizona carry out an enquiry. To this end, a total of 1,200 firemen simulated an accident and rescue. The staggering conclusion was that the procedure in place does not work inside larger industrial buildings; on average, a fireman carries oxygen with him that lasts for 18.5 minutes, whereas the rescue procedure described required a minimum of 22 minutes. In addition, it became clear that once they get into trouble fire service personnel activate the emergency procedure too late. To such an extent, that is virtually impossible to save them. They also found that dragging a colleague requires at least two to three people. The thought that you may be saved and carried outside by your buddy is a myth. Perry's main recommendation is to prevent rescue operations by adjusting the standard deployment procedure. When in industrial buildings, initially opt for the outside fire attack, unless it is clear that an inside fire attack is possible.<sup>37</sup>

The procedure 'own personnel missing' covers more than just drawing up a deployment method. The procedure requires validation through testing in real life. The procedure needs to be implemented by training the fire service personnel, and not stop at the rescuing techniques, but create awareness of the situation: report on time when you get into trouble, be aware of the risk when you are walking onsite. Realise that, being the rescue team, it is harder to rescue own personnel than carry out a regular rescue operation, and that your body may respond to that with an increased heart rate and an increased use of oxygen etc. This will also get you as a rescue worker into trouble.

Finally, the procedure should also relate to the available technical equipment, such as localizers, stretchers etc. To this end, it is important to realize that the current techniques cannot always be trusted. The signals 'man down' from the firemen had been sent alright, but the large part was only received<sup>38</sup> after the bodies had been recovered.

<sup>36</sup> S. Kreis, *Rapid intervention is not rapid*, essay published on firehouse.com.

<sup>37</sup> R. Perry, *Rescue Sector Training Exercises, Final Data Report*; University of Arizona report, 2002.

<sup>38</sup> The Officer-in-charge from the TS 3111 has indicated to have heard outside one of the 'man down' signals, right after the flash-over. As soon as the circumstances allowed it for, this is where the search started, to find out later that the bodies were located elsewhere.

The Committee of enquiry also recommends that a workable emergency procedure be drawn up and implemented. This is an assignment that is presently beyond the capabilities of the municipality of Tynaarlo. However, it can be ascertained by the municipality that, under the present circumstances, a definite guarantee cannot be given that the necessary help will be provided for missing personnel. This imposes additional responsibility on the municipality to draw up procedures stipulating exactly which situations present a risk for the fire service.

## **Overview: summary and view**

### *From alarm to a sudden spread of fire*

On the afternoon of Friday, 9th May 2008, a ‘house fire’ alarm message is received by the fire service in Eelde. While the first unit (the TS 3111) is on its way to the scene, additional information is received stating that the fire is in the meter cupboard of a boatshed at the De Punt shipyard. This large boatshed (measuring approximately 75 by 25 metres) is well known to most of the seven occupants. On the way, they discuss the potential dangers that can be encountered as a result of their deployment to the boatshed. The ambience in the fire engine is quite tense; this is a real fire and this occurs very seldom.

At the roundabout in front of the boatshed, a thick brownish-yellow plume of smoke can be seen ‘drifting away’ from the rear of the building. The occupants have no doubt that this unusual smoke pattern presents a potential danger. They unanimously decide that this constitutes sufficient grounds for declaring this to be a ‘medium fire’ and for summoning an extra unit to provide additional assistance at the location.

After the unit has made a U-turn so that they are upwind in front of the boatshed, the situation appears to be completely different: when standing directly in front of the large boatshed, and looking through the enormous door that is rolled open, the only smoke that can be seen is at the extreme rear of the boatshed. They have also been informed that a car is on fire on the left-hand side at the rear of the workplace.

Based on this new appraisal of the situation, the firemen are ready to act: it is a covered car fire that can be extinguished by entering and attacking it. However, outside on the left-hand side, the route to the rear of the building is obstructed by all kinds of boats; outside on the right-hand side, there is an obscure narrow route between the boatshed and waterfront; straight ahead, there is a direct unobstructed route through the middle of the boatshed. The car fire will therefore be attacked using a high-pressure hose that will be transported through the boatshed. The formal command from the officer-in-charge, i.e. ‘investigate and possibly extinguish the hearts of the fire’, is just protocol; however, they are convinced that they will be able to bring this fire under control.

The attack team and water team thus take the 90-metre long high-pressure hose with them as they enter and proceed directly to the rear of the building. In accordance with standard procedure, the officer-in-charge looks to the right. The driver / pump operator and the ‘seventh man’, together with a fireman who arrived later by his own means of transport, are all involved in operating the pump and ensuring optimal water extraction. After about 15 metres, the high-pressure hose becomes snagged. One of the firemen turns around and walks back to the exit to release the hose.

However, the firemen at the front of the boatshed cannot see that, during this period of approximately 2 to 3 minutes, the situation at the rear has deteriorated dramatically: a black plume of smoke is being forced out of the ridge of the roof, and yellowish-brown smoke is billowing out from the edge of the roof.

The deployed firemen only notice this when it is already too late. The fireman who was the releasing the high-pressure hose is blown off his feet by a blast wave, and a column of fire and pitch-black smoke is forced outside through the door opening. The fireman in the door opening crawls a few metres to safety on his hands and knees; the other three firemen are left behind in the building in the inferno that suddenly engulfs the entire hall. All contact with them by walkie-talkie is immediately lost. A few seconds later, the entire door construction comes crashing down.



At 14:21, the officer-in-charge of the TS 3111 reports to the control room that the fire has escalated out of control and that some of his personnel are missing. Afterwards, his account of what has happened certainly rings true: the raging fire at the left rear of the workplace in the boatshed has already had at least ten minutes to escalate to attic level.

The insulation at the rear and for roof consisted of sandwich panels with polyurethane foam between them. When they were heated, they gave off extremely combustible brownish-yellow nitrous vapors. The wind that was blowing directly into the boatshed, initially blew these vapors outside, especially at the rear, and also helped to keep most of the boatshed free of smoke. Turbulence effects would probably have also produced a layer of smoke against the ceiling; however this was hardly visible from the door opening: the smoke remained against a non-illuminated ceiling and the view was obscured by the large door panel (measuring approximately eight by five metres) that was in the open position and pointing directly backwards into the boatshed. The fire that continued to escalate caused in this layer of smoke to become even denser, in the ridge of the building until the moment when the flames came into contact with the combustible gas layer. This resulted in a spillover of fire with a powerful blast effect throughout the entire building.

Despite the fact that the firemen who were present had been well trained in accordance with the national guidelines and were well rehearsed for their task, the sudden spread of fire was a completely new scenario for them. Just like all Dutch firemen, they are specially trained in the sudden spread of fire due to heating in confined areas (i.e. ‘flash-over’, as described in the definitions in the training documentation) or a flashback caused by allowing oxygen to enter a closed-off area (i.e. ‘back-draft’, as described in the training documentation). In this high space with its gaping door opening, they could barely contemplate that a fire would spread so suddenly. Moreover, since the firemen, who were present, just like all firemen, are a product of many years of training and exercises, they found it difficult to imagine that it was unsafe, and indeed, did not see any reason why it should be unsafe. Thus, the current deployment procedure is crystal clear: an inside fire attack is the correct instrument.

Moreover, with regard to the situation posed by the fire on 9th May 2008 in De Punt, the committee of enquiry also concluded that virtually all firemen would have acted in the same way, and would have therefore walked into a deadly trap.

According to the committee of enquiry, there was only one possible and necessary solution: in industrial buildings where fire safety requirements are not in force, the current deployment procedure must be reversed: in the event of fire in such a building, a defensive outside fire attack must always be adopted. In exceptional situations, a decision to conduct an inside fire attack can only be made when enough extra units are available and when assurances can be given. However, in practice, this will not or hardly ever occur because the fire will spread. The training documentation, training and exercises must be adapted to reflect this.

#### *After the sudden spread of fire, rescue and recovery*

After the sudden spread of fire, the firemen of the first unit from Eelde were very shaken up and they hoped, against all odds, for a miracle to happen. In consultation with the control room, the officer-in-charge states that it is an ‘extremely large fire’. At that moment, a second additional bus from Eelde arrived on the scene. This bus contained personnel and equipment (front-mounted pump with three additional firemen). All of them then tried their utmost to protect the high-pressure hose that was lying in the area where the fire was raging, and via windows, to cool in the direction where they assumed their colleagues were. To do this, they had to organize the optimal extraction of water from the canal, install the hoses and a manifold, and arrange the supply from the first fire engine. All of this took time.

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After approximately five minutes, assistance arrived in the form of the fire engine from Vries (14:26). The 'rescue plan' remained the same: to direct a lot of water through the door opening in order to decrease the temperature, and to obtain some degree of vision in the pitch-black smoke as a result of the sucking up action of the water jets. For this, the unit from Vries installed a water cannon that directed water through the door opening.

Shortly after the unit from Vries, the Duty officer also arrived at the scene. He did not succeed in effectively taking over the management of the rescue that later became a recovery operation. In view of his selection, and the training and exercises that he had participated in, this could also not have been expected from him.

In consultation between the control room and the officer-in-charge from Vries, approximately two minutes later (14:28), it was decided to summon additional assistance from an extra fire service unit. The airport of Eelde offered to provide its crash tenders.

It was at this moment, approximately ten minutes after the sudden spread of fire, that (according to the indications that were later observed on the breathing equipment) the air supply for the trapped firemen expired so that they died from asphyxiation. At that moment, in all probability, at least two of the firemen were already unconscious due to the excess heat, while they became disorientated in the pitch-black boatshed while searching for an exit. The third fireman probably disconnected his breathing apparatus and became unconscious as a result of carbon monoxide poisoning, before dying.

In the opinion of the committee of enquiry, it is clear from the facts that there was no way of rescuing the trapped firemen: their breathing air had expired before adequate equipment could be brought to the scene to rescue them.

From 14:33 onwards, additional units quickly arrived at the scene. Efforts were made to try to extinguish the fire from several sides and to enter the boatshed in order to try to recover the bodies of the firemen who died. At approximately 15:00, various Officers-in-charge decided that the fire was sufficiently under control for a new inside fire attack to be launched. The bodies of all of the victims were then recovered within 15 minutes.

The committee of enquiry concluded that the rescue and recovery attempts were not properly coordinated. The main reasons for this were the lack of an optimal and well-rehearsed 'own personnel missing' procedure, and the fact that fire service officers are not selected, trained and do not participate in exercises to make the necessary difference in such a situation as fire safety engineering managers'.

The committee of enquiry also recommends that Dutch fire service draws up an optimal 'own personnel missing' procedure and that the municipality of Tynaarlo implements it. Furthermore, the committee of enquiry recommends that the municipality of Tynaarlo and the regional fire service of Drenthe select officers on the basis of competence, and that more focus should be given to participation in exercises and the evaluation of the officers in relation to fire safety engineering.

To sum up, the committee of enquiry recommends that in relation to the fatal fire in De Punt on 9th May 2008, this should be a wake up call for the Dutch fire service to once more continually invest in its core task, i.e. expertise in fire safety engineering. In this context, this did not relate to 'the risk posed by the profession', but to an incident that could have been avoided. In the opinion of the committee of enquiry, the fire service officers who were involved could not be blamed: they acted in more or less in accordance with the existing procedures and they were not aware of the risk.

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According to the committee of enquiry, additional investments must be made in enhancing knowledge of fire safety engineering, and in adapting procedures, training documentation, training and participation in exercises based on the results.

## **Annex 1**

### **The investigation request**

The following investigation request for the committee of enquiry was drawn up by the municipality of Tynaarlo:

The dramatic incident in our municipality in which three of our firemen lost their lives, provides justifiable grounds for various investigations by, for example, the Labour Inspectorate (“Arbeidsinspectie”) and the Dutch Safety Board (“Onderzoeksraad voor Veiligheid”). These investigations will take many months. In view of its autonomous duty to have regard for the welfare of the personnel of the fire service, and its own accountability to the Council and population (“Raad en bevolking”), the Municipal Executive cannot and does not want to wait for the results of the aforementioned investigations.

The Municipal Executive therefore wishes to conduct a rapid and independent investigation so that the most important lessons relating to the events can be quickly learnt.

The Municipal Executive therefore requests the committee of enquiry to conduct an independent investigation (as stated above) into the possible cause of the fire, the fire behaviour in relation to the deployment of the emergency services and the degree of effectiveness of the training and participation in exercises for gaining control over this type of fire.

More specifically, attention must be paid to:

- research relating to the cause and development of the fire, and in particular, the (preventive) fire safety engineering aspects;
- fire behaviour in relation to fire-fighting, especially the way in which the fire progressed and the fire-fighting took place (this relates to the operational technical aspects of the fire-fighting);
- the preparations for the deployment of the firemen in as far as this is relevant for this type of fire (training, participation in exercises, procedures).

The question is whether or not the analysis provides sufficient grounds for adapting procedures and training.

## **Annex 2**

### **List of persons interviewed**

This annex contains a list of the persons interviewed. For reasons of anonymity, these persons are only designated by their job title in relation to the incident.

An interview was conducted with the officer-in-charge, numbers 2 and 7 and the driver / pump operator from TS 3111 (Eelde)

An interview was conducted with the officer-in-charge and a fire crew from TS 3131 (Eelde). An interview was conducted with the officer-in-charge and a fire crew from TS 3311 (Vries).

An interview was conducted with the officer-in-charge and the station commander from TS 535 (Haren).

An interview was conducted with the chief fire officer from the airport fire service at Groningen Airport Eelde. In relation to this investigation, an interview was also conducted with the managers of the fire service at the scene, i.e. the Duty officer and the head of COPI (commander training preparation and optimization) which is part of the NIFV, the Dutch Institute for Physical Safety. An interview was conducted with the coordinator of the control room.

An interview was conducted with the first two police officers to arrive at the scene.

An interview was also conducted with owner of the boat yard and her daughter.

In relation to the part of the investigation focusing on the preparation, an interview was conducted with the regional training and exercise coordinator, the exercise coordinator at Tynaarlo, and the chief fire officer at Tynaarlo.

### **Annex 3**

#### **Additional view of decision-making mechanisms**

From various research projects, it is evident that decisions are made in various ways, depending on the situation in which people find themselves. However logical this may sound, until recently, it was assumed that, as a result of rational thought, people can always come up with the best alternative from a number of possibilities. However, this is not entirely synonymous with the repressive life experienced by fire service personnel, and we will discuss this in more detail in this annex.

More specifically, the cognitive science aspects of psychology are devoted to researching information processing by people, based on processes such as attention, observation, learning and decision-making. The decision-making process during fire-fighting can be regarded as a kind of information processing. Information must be collated, by means of observations and conversations. The information has to be processed and weighed up, and a decision has to be made, so that this can be followed by an intervention. In an ideal world, information is comprehensive and reliable, and a decision can be regarded as the most logical or economic decision based on rational analysis. However, during fire-fighting, reality is a long way away from this ideal world. Scraps of information that are often only sparsely available are disseminated in different ways (by visual and auditive, oral and written means). Often, a consciousness of time pressure often exists, where one is not only confronted with the grave responsibility of having to assume control of the incident, but also of having to act quickly on the basis on incomplete information.

It is therefore up to the employer to compensate for the weaknesses of decision-making under time pressure by introducing organizational measures such as automatic scaling-up, in order to, for example, minimize the negative effects of tunnel vision and time compression.

#### ***Klein: recognition prompts decision-making***

One of the most important theories about the way, in which the Officers-in-charge make decisions whilst under time pressure, was developed by G. Klein in the 1990's. From 1985, Klein conducted research into the way in which professionals make decisions whilst under substantial time pressure and stress. For example, his research includes observations of Officers-in-charge at the New York fire department.

The theory is described in terms of 'recognition-primed decision-making' or 'recognition prompts decision-making'.

The theory developed by Klein proposes that when professionals make decisions under time pressure, they seldom compare alternatives in order to choose the best option. It seems to be the case that they evaluate the situation, and based on their evaluation, choose a suitable option (that is not always the best option). According to Klein, the decision-making mechanism consists of the following three steps:

*Recognition of the situation:* the decision-maker recognizes the situation as being familiar or new. A familiar situation is associated with a series of actions that are also known and regularly rehearsed. A new situation requires a series of actions that are still unknown (although the actions themselves may well be known). Recognition takes place based on a limited number of indicators and 'causal' development steps that, in the case of the decision-maker, explain the present situation as well as the expected development of the situation. Based on this, the decision-maker draws up his attainable objectives and then selects an appropriate action as follows:

*Serial alternatives, comparison:* based on his experience, the decision-maker prepares a series of alternative actions that can result in the intended objective being fulfilled. The order of these alternative actions is determined by 'how often they have already been (successfully) used in this situation'. In order to see whether an alternative satisfies the requirements, the decision-maker uses:

*Mental simulation:* in thoughts, the series of actions are performed, and thought is given to how they will work out and affect the development of the situation. Caution: the decision-maker initially only does this for the first series of alternative actions in the list. If these satisfy the requirements, he will implement this decision (even though it is not optimal); otherwise he will check the next in the list, again by means of mental simulation.

***Rasmussen: Cognitive control of the decision-making processes***

In his research, Rasmussen differentiates between three types of decision-making: decision-making based on skill (skill-based), rules (rule-based) and knowledge (knowledge-based).

Decision-making based on skill: the decision-maker reacts immediately and almost subconsciously to the situation. Examples of this are simple motor actions such as driving a car, but also equipping yourself with breathing air, and the way in which a burning building is entered (caution: the decision to use breathing air is usually based on rules (rule-based)).

Decision-making based on rules (that are drummed in): this is closely related to the first type of decision-making. The difference is that the rule is now consciously implemented. An example of this is withdrawing if the explosion meter sounds an alarm.

Decision-making based on knowledge: when the situation is new, it will have to be considered, together with the objectives and the alternatives. According to Rasmussen, this takes place by using symbols that represent the information. These symbols thus denote a model of the situation: for a process operator, the lamps and indicators on the control panel represent reality. Rasmussen therefore states that a careful choice of symbols can provide support for the decision-maker.

***The dangers of automatisms and 'fiddling around'***

One important point that is worth noting in the models van Rasmussen and Klein is that the models focus the attention on the automatism of skill-based actions taken by the decision-maker. If a decision-maker is requested to make a decision in a situation that closely resembles a standard situation, the decision-maker will decide almost automatically (i.e. without considering alternatives). This automatism can lead to accidents happening. One of the ways in which this automatism can lead to accidents, was discovered by Rasmussen in relation to process operators: i.e. the 'fiddling around'. During a complex incident, process operators tend to want to solve minor secondary problems 'on the machine' ("in order to extinguish that red lamp, I do this or that"). In so doing, they do not obtain an overall picture of the incident. Fiddling around is thus the tendency for people in a problem situation to tackle secondary problems almost subconsciously, based on their skills (skill-based), with them consequently running the risk of losing sight of the overall picture.

When tackling the incident on 9th May, the danger of automatisms is evident: standing in front of the open door of the boatshed, the only thing that crew of TS 3111 'could' do was to act on the basis of the details that they saw at that moment. However, they were oblivious of the overall picture that included the large amount of peculiarly coloured smoke that they had observed only minutes earlier at the rear of the building.

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### **Confirmation bias**

As a 'normal' human being, it is also not easy to recognize a new feature. In other words, the mechanism of 'confirmation bias' means that when one is searching for additional information, special onus is given to searching for information that endorses the picture (that has already been formed), and that information that this falsifies this picture, goes unnoticed. Different types of confirmation bias exist that are relevant to the incident in De Punt, i.e. 'primacy effect', 'selective searching', 'limiting the scope of attention', 'truth bias' and 'groupthink'.

*Primacy effect:* When using the term 'primacy effect', we mean that information that is initially supplied is regarded as having the most importance in terms of decision-making. Everything that is observed or heard later is regarded as being less important. In this case, the TS 3111 as called out for a 'house fire', and after the TS 3111 responded, the status of the incident was changed to a 'fire in a meter cupboard'. Both announcements indicated that it probably related to a small fire that was easy to bring under control.

*Selective searching:* The fact that the locality was already well known to the TS 3111 resulted in the attention of the crew being focused on the aspects that they were already familiar with. During the response period in the AS, all of the potentially hazardous aspects were summed up and discussed by the members of the crew. Upon their arrival at the scene, these aspects took precedence: the fire at the rear of the building did not pose any threat to the gas cylinders, etc. However, no effort was made to look for other potential risks. In this case, the fire resistance of the insulation material and the possibility of a sudden spread of fire causing the entire boatshed to go up in flames, were not taken into account.

*Limiting the scope of attention:* Limiting the scope of attention also results in the attention being restricted to a limited area. This is literally a kind of tunnel vision. One can see everything in a small area, however the overall picture becomes fragmented and incomplete. During the fire in De Punt, the attention was fully focused on the rear of the building, where the car workshop and the meter cupboard were located. This meant that an optimal overall picture was never formed during the initial phase. Although the first unit to arrive at the scene spoke to the people there, these people were not questioned enough, and no real investigation took place outside, the unit immediately entered the building. The reason for this was that they were already focused on the rear of the building because of the announcement from the control room stating that there was a "fire in the meter cupboard". Moreover, the firemen knew that the meter cupboard was located in the car workshop.

*Truth bias:* It is difficult to dissociate oneself from the picture that already exists. Research has revealed that people are more inclined to accept a hypothesis as being reality, than to reject it. Linked to tunnel vision and selective searching, this results in behaviour where one tries hard to endorse one's own view. Indicators that could lead one to reject the hypothesis are not looked for, not seen, or not regarded as being credible. It is therefore inhuman to expect that the officer-in-charge / crew of TS 3111 were capable of constructing a scenario, for example, based on the observation of smoke at the rear of the building, in which the sudden spread of fire would cause the boatshed to collapse. With hindsight, we can now of course say that this was a serious risk: uncovered steel constructions can give way after approximately 16 minutes. After the alarm was given, the traveling time for the 3111 was approximately 11 minutes, including the arrival time at the fire station. When you combine this with the discovery time and the alarm time, you can presume that it was already burning for approximately 15 minutes, thus almost the length of time required for the building to collapse.



*Groupthink:* Groupthink can occur in situations where a strong leader must perform a clearly defined assignment in isolation with a group. It is our belief that this premise is applicable to every fire engine crew. There is a designated leader, the officer-in-charge, who together with his crew, tackles a clearly defined assignment, i.e. extinguishing the fire. In groupthink situations, critical behaviour towards each other and towards “the plan” is seldom evident. In as far as the plan already exists in terms of confirmation bias, as a result of groupthink the group will also refrain from criticizing the plan. This could give the leader the impression that his hypothesis has been additionally endorsed: one could have intervened, but one did not do so. So, it must be true.

