Murphy visits Anderlecht

1 Introduction

20th of August 202, Murphy was a guest in the Victor Olivierlaan in Anderlecht, Brussels. Murphy's Law says: If something can go wrong, it will go wrong. That day, multiple things went wrong at the same time. It resulted in a very challenging fire for the Brussels Fire Department.

The fire department was alerted for a fire on the 11th floor of a 12-story building. The default procedure of the Brussels Fire Department for fire in a building consist of an pumper truck and an turntable ladder from the station which is closest to the fire's location. With them comes a command vehicle, a second turntable ladder, a second pumper truck and an ambulance from headquarters at the Helihavenlaan. The Military hospital also sends an Emergency Rescue Team (which as a doctor on board). In case of a high-rise building fire, a third pumper truck will be sent out.

Image 1 The fire becomes raging just after the arrival of the fire department. *(Picture: Marc Baert)*

This is when Murphy passed by for the first time that day. The turntable ladder from the Anderlecht fire station was already called out for another intervention at the moment this fire call came in. The pumper truck had to depart alone. Since the headquarters was the second closest fire station able to send out a turntable ladder truck, they sent out two at the same moment. Dispatching received a lot of phone calls about the fire. Because of that, a second command vehicle was also dispatched right away. Immediately upon arrival of the first pumper truck, its crew commander asked for an extra pumper truck. A 4th pumper truck was dispatched. During the intervention, another 2 pumper trucks were sent to the location. This makes a total of 6 pumper trucks for this fire.

The subject building was an old building that dated from before fire prevention laws. To make it even more difficult for the fire department, the main entrance of the building was on floor -1. This made it difficult for the teams to orient themselves in the building. Such situations also occur in recent buildings, causing confusion. It is therefore very important that there is a clear marking of the floors in such buildings.

The construction method led to a very complex way of working. In a modern high-rise building, there must be two staircases. The stairs must be straight to make evacuation easier. In addition, there must be a riser pipe that ensures that the fire department has water on every floor. None of all that was present. There was no riser pipe and therefore no water to extinguish with. There was only one staircase and it contained a spiral staircase. A spiral staircase makes it about impossible to let residents flee downstairs and firefighters go upstairs to extinguish the fire at the same time. To top it all off, the elevator

was not available. Our people had to go up the stairs while a lot of residents tried to flee from the smoke. Murphy came lurking around the corner again.

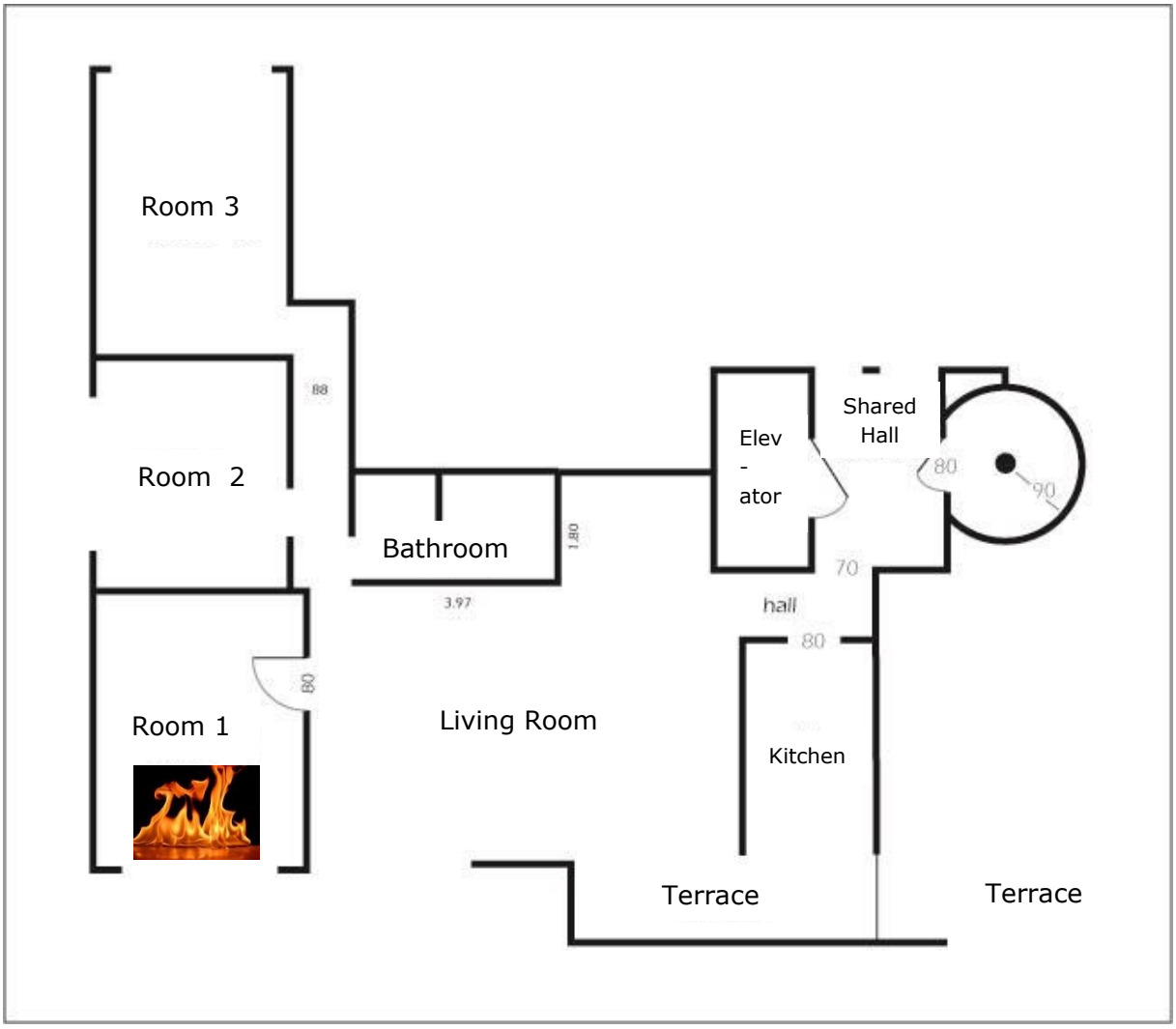

Image 2 Floorplan of the apartment in which the fire started. It was raging out in room 1. *(Image: Brussels Fire Department)*

Despite these very difficult circumstances which were the result of various factors, the fire was extinguished and all wounded were saved. Good job!

2 Tactics

The company officer commanding the first pumper truck, adj. Schmit, was therefore faced with a very challenging situation upon arrival. This was brought to a head when, during the reconnaissance, the window of the burning room broke and fell down. The debris landed just beside his team. As a result, the fire itself had created a large ventilation opening and became raging.

Image 3 The fire becomes fully developed. Notice the smoke escaping from the other windows. *(Picture: Marc Baert)*

By default in a high-rise building, the hoses are coupled on the riser pipe on F-1 (the floor below the floor at which the fire is going on). However, the adjutant could not find a riser pipe during his reconnaissance … So it turned out differently. He decided to work with a mobile riser hose.

2.1 Mobile riser hose + interior attack

When working on a mobile riser, cassettes of 70 mm are used. Firefighters go upstairs as the hose comes out of the cassette. In this way, water is supplied to the top through a hose of 70 mm. The intention is to lay out until below the fire floor. A three-way manifold is placed there. Bundle hoses (Cleveland hoselay) are then connected and firefighter work their way up with a charges hose to attack the fire. Adj. Schmit decided to deploy his team on this task.

2.2 Evacuation/guided rescue

As his team moved up to install the mobile riser, they were confronted by many residents who fled down the stairs. There were so many that the team could no longer progress. Passing each other on a narrow staircase is very difficult if one of the two has a breathing apparatus on his back.

Image 4 A firefighter brings an elderly lady to safety. Notice the limited space due to the spiral staircase. *(Picture: Luc Van Ussel)*

There were a lot of older people who were intoxicated by the smoke. They urgently needed help to escape the building. The team of the first pumper truck has stopped laying the mobile riser. Their tactic now consists of getting as many people to safety as possible. An enormous amount of work is being done here in a short period of time: people are helped down the stairs, others are placed in a lobby on a smoke-free floor, … The five firefighters really made the difference for those residents there. They can now continue working on laying the mobile riser. However, this is very difficult in the stairwell, which is completely covered in smoke on the upper floors. Visibility is reduced to almost zero there. Moreover, the firefighters have lost count of the floors due to the frequent going up and down during the rescue of the people in the stairwell.

In the meantime, reinforcements of the headquarters have arrived. They have no clue about the situation inside at that time. One of the two pumper trucks is used for search & rescue. However, they also end up on the stairs where their colleagues are still fully engaged in a guided evacuation and where the mobile riser has not yet been completed. One of the chief officers takes command outside while the second chief officer goes upstairs

to coordinate. However, he also gets stuck in the smoke with the teams that are still waiting for water to launch the attack. *Why is it that the stairwell so many floors below the fire is already completely covered in smoke?*

2.3 Transitional: Exterior attack using the turntable ladder truck

The fire is still raging at that moment. The outside chief officer asks the inside chief officer if an exterior attack can be launched from the ladder. The officer inside confirms. The turntable ladder then launches an exterior attack. They manage to knock down the fire within a few seconds. This removes the risk of fire spread upwards, as well as the risk of fire spreading from the bedroom to the living room.

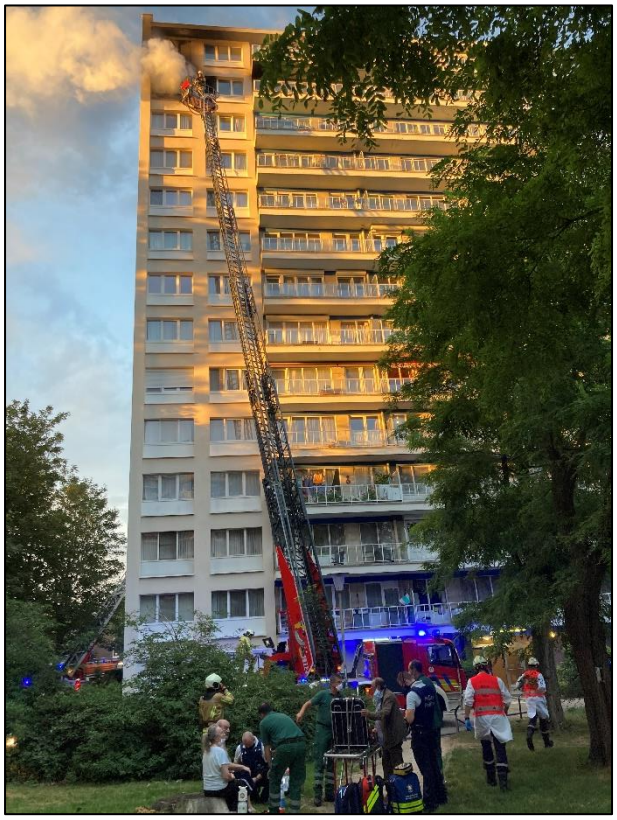

Image 5 The turntable ladder truck executes an exterior attack at the burning bedroom. *(Picture: Marc Baert)*

During the intervention, the turntable ladder truck will make a total of 5 exterior attacks to maintain control over the fire in the apartment.

Later in the intervention, teams gained access to the apartment. However, they still have no water. There is still quite a fire in the bedroom. The flames still flare up a meter and a half high. The teams succeed in quickly ventilating the entire apartment by opening windows. Subsequently, a rapid search for victims is carried out. Whenever the fire gets too big, the turntable ladder truck is asked to knock the fire back down. This is maintained until a Cleveland hoselay is connected to the mobile riser that allows the firefighter to extinguish the fire in the bedroom.

2.4 Interior Attack

The crew of the first pumper truck from headquarters will carry out an interior attack. Initially, the door of the lobby is opened. It concerns the "Shared Hall" in figure 2. Although there appears to be a lot of smoke there, there is only little heat. They decide to also break open the entrance door of the apartment. After all, the raging fire was knocked down by the turntable ladder. They also do not find excessive heat in the apartment. They place a smoke stopper in the entrance door of the apartment to stop the outflow of smoke in the direction of the stairwell.

2.5 SAR

A next team is sent to the 12th floor to execute a search & rescue. There is a lot of smoke on the floor above and it is possible that people are trapped in their apartment. The teams are having a very hard time. They have to open the door with a Halligan Tool while wearing

SCBA and in a limited visibility. The training program about forcible entry has clearly paid off here.

Once inside the above apartment they can confirm very fast that no victims are to be found there.

2.6 Building a second line at the rear façade

Since it takes a very long time to put an attack hose along the stairwell, the incident commander chooses to initiate a plan B. He has the second turntable ladder set up at Charlie side along with the fourth pumper truck. They build a supply hose on the turntable ladder truck. The intention is to enter the building via the floor below the fire. They can proceed to the stairwell through the apartment at the rear façade.

If it would not be possible to lay down the mobile riser at the stairs, extinguishing water can be supplied via that alternative.

In the end, the mobile riser was completed faster than plan B and the hose on the turntable ladder truck was not used.

2.7 Ventilation

The second pumper truck of headquarters has been busy with ventilation. An opening was first made on the 12th floor. Next, a ventilator was placed at the entrance. This was a very powerful combination.

The smoke stopper in the entrance door of the burning apartment ensured that little extra smoke was added to the stairwell. As soon as this device was set up, the smoke was vented from the stairwell. This meant visibility came back. In addition, the floors below the fire became usable again for the evacuation of residents.

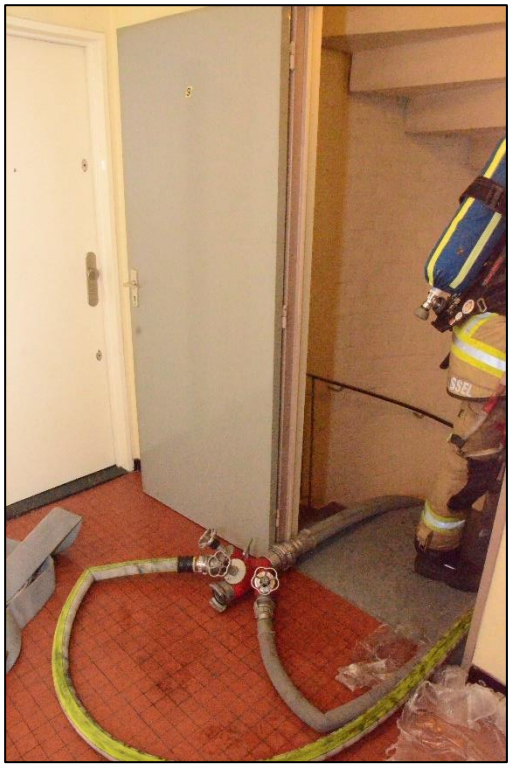

Image 6 The threeway manifold at the end of the mobile riser hose. A hose of 70mm arrives at it, while two hoses of 45mm leave for the upper floor. *(Picture: Luc Van Ussel)*

3 Issues

During this intervention, the fire department faced a whole lot of issues. Some of them were already mentioned above. The most important onces are talked through below.

3.1 No water riser

Extinguishing a fire asks for water. In Brussels, there are still many high buildings in which there is no water pipe at all, where there is a dry riser that is out of use or where the wet riser is out of use. Such a situation is also encountered during the construction phase or during demolition of a

building. A law which describes the presence of a riser pipe at those times would contribute to a higher level of safety.

The lack of a water riser leads to a lot lost time.

Because of the confusion about the number of floors, the mobile riser was originally extended to the fire floor. While the firefighters thought they were on the floor below. The fact that everyone was in the smoke contributed to the fact that it took extra long to have an armed hose on the 11th floor. During the pressurization of the mobile riser, one of the hoses burst under the high pressure. This hose had to be replaced, which led to even more delays.

3.2 Spiral Staircase

Image 7 View at the spiral staircase with the mobile riser hose on it. *(Picture: Luc Van Ussel)*

The spiral staircase limited the available space to work in significantly. As described above, descending residents and ascending firefighters could not cross each other. This made it easier to temporarily "park" fleeing people in lobbies a few floors below the fire. However, there was no pictogram with the number of the floor in those lobbies. There was only a small plate with the number of the floor attached high on the door as shown in image 6. All this contributed to the fact that after a while the teams no longer knew which floor they were on.

3.3 Reverse stack effect

Hot air rises. This is the principle behind a hot air balloon. This also leads to a flow in a building. In most cases it is warmer inside than outside. This means that a flow is created from bottom to top in the stairwell, the elevator shaft and vertical technical shafts: the chimney effect or, with an English name, the stack effect. This can be seen on the left of image 8. The strength of this effect is proportional to the height of the building and the difference in temperature between inside and outside.

There is also something like the reverse chimney effect or the reverse stack effect. If the outside temperature is higher than inside, the direction of the flow reverses. Suddenly, there is an downwards airflow in the building. This can be seen on the right of image 8. This situation is not very common in Belgium. It can occur in buildings that are fully air-conditioned. However, the day of the fire in Victor Olivierlaan fell into a heat wave. It was incredibly hot outside and therefore cooler inside than outside. In this fire, this led to a strong airflow from top to bottom. The flow was strong enough to send a lot of smoke down. The smoke descended at least to the 6th floor. SCBA was already fitted at that point.

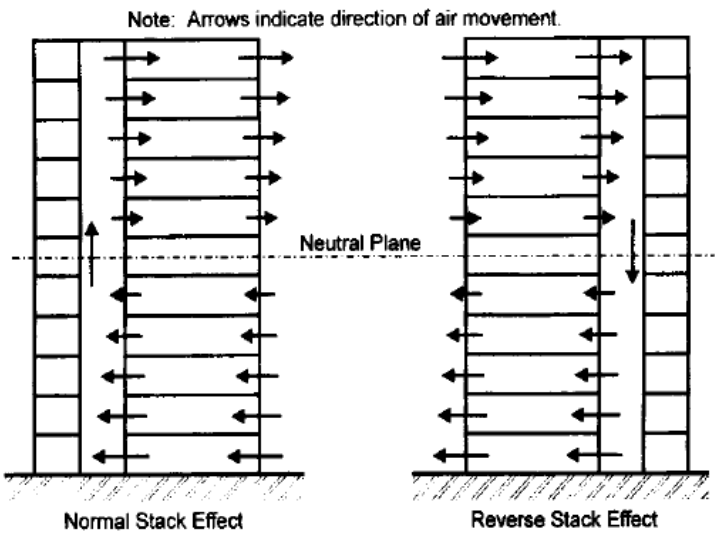

Image 8 *The movements when having Stack Effect and Reverse Stack Effect.*

It is common knowledge that temperatures are rising because of climate change. In recent summers, there were many more days with high temperatures than about ten years ago. This also has an effect on firefighting. The occurrence of a flow from above and the downward spread of smoke are therefore a consequence of climate change and will happen more and more in the future. On one hand, this makes that the escape routes immediately below the fire become unusable for escape. Firefighters testified that "smoke was coming down faster than people with reduced mobility could evacuate". The fire department does not expect that residents below the burning floor will need much assistance to escape or that they will be able to stay safely in their apartment. Due to climate change, this is no longer a certainty. *Murphy had made another appearance.*

On the other hand, this phenomenon makes it harder for firefighter to do their job. In limited visibility or zero visibility, there is a loss of efficiency in comparison with good visiblity.

A last effect of the high outside temperature is firefighters suffering from heat stress. This means time to cool down is needed and that personnel is required to create a *rehab-zone.*

Image 9 This picture was made after the fire was put under control. There is still enough smoke at the 9th floor to make SCBA indispensable. In the back of the picture is visible that there is even more smoke in the staircase hall. *(Picture: Luc Van Ussel)*

It also means that SCBA-equipped firefighters will have to be replaced more quickly. In summary, the high outside temperature causes a reverse stack effect on the one hand and heat stress on the other. As a result, more personnel is needed for firefighting than for the same fire in the same building at a time when the outside temperature is a lot lower.

3.4 Command and communication

One of the things that really went well during this intervention was a very fast upscaling. It was immediately clear to dispatching, the senior officers and the adjutant of the first arriving pumper truck that this would be a major incident. Because of this, extra units were sent out faster than usual. These units also arrived relatively quickly.

The disadvantage of this is that a lot of people have to communicate with each other. In Brussels, this often takes place via one communication channel. That did not work out in this intervention. There was just too much communication. This made it difficult or impossible for the two chief officers to reach each other. Company Officers could not reach their chief officers.

In Belgium, no Incident Command System has yet been introduced. With major interventions that evolve quickly, such as this high-rise fire, it quickly becomes clear why this is a failure. The management of the teams did not go quite smoothly.

4 Lessons learned

The intervention in Anderlecht was quite a challenge. There were a lot of problems that the Brussels firefighters were confronted with. Nevertheless, they managed to extinguish the fire and bring all residents to safety. The intervention was therefore a success despite all problems. This means there are some interesting lessons to share.

4.1 Mobile riser in smokefree space

In Brussels, the mobile riser is standardly used up to the fire floor -1. This is based on the idea that there will be no smoke below the floor where the fire is raging. After all, it is not advisable to start connecting hoses in the smoke. This is better done good visibility.

However, it is not always correct that the fire floor is filled with smoke and the floors below are not. In large buildings such as large hotels or hospitals, there may be no smoke even on the fire floor itself, except for close to the burning room. In that case, the riser hose can be extended to the floor at which the fire occurs.

However, in this specific case there was smoke down to the fire floor – 5. The lesson here is that it is best to lay hose to the end of the smoke-free zone. This is to be able to connect hoses in a smoke-free environment, but still get the threeway-manifold as close as possible to the fire. A threeway-manifold that is closer to the fire leads to less pressure losses (and can therefore supply a higher floor with extinguishing water) and therefore a higher flow rate.

Another concept is about the cooperation between different pumper truck crews. If it is certain that several pumper trucks will arrive shortly after each other, then the first pumper truck that has arrived can start to initiate the built-up of the mobile riser. That is their assignment at that moment. As soon as they are done with this, it is the intention that they make room for the team of the second pumper truck. They can connect their Cleveland hoses to the threeway-manifold and proceed to attack the fire. If the elevator is available, the second crew can take the elevator to fire floor -3. Then, they have not made the effort

to climb the stairs with all their gear. They are fitter to start fighting the fire. This tactic can be compared to soccer where a midfielder passes to a striker so that the latter can score. Firefighting is a team sport!

Of course, the above is easy in theory. In Brussels, there are sectors where reinforcement will take a little longer to get on scene. In that case, it may happen that a second pumper truck is not yet on site when the mobile riser hose is ready. In this case, after installing the mobile riser, the team will have to start the inside attack itself. It is the commander of the first pumper truck on site who has to estimate this.

Image 10 Being a firefighter means team spirit! One player passes the ball to another that will make the point. Just like the one pumper truck crew that provides a mobile riser hose so another crew will be able to extinguish the fire. *(Picture: Decathlon)*

4.2 Use of thermal imaging camera

The thermal imaging camera is a very good tool to find the fire or victims during interior firefighting. In a situation such as this one, it can also be used to observe the flow of the smoke.

If smoke flows from the floor to the staircase through the door opening, then this is probably the floor at which the fire occurs. The temperature of the smoke will also provide some information.

4.3 Different radio communication channels

When dealing with a fire in a high-rise building, different radio communication channels should be used:

- As soon as if there are more than three pumper trucks are active on site, it comes in handy to use multiple channels to work with. For example one for the extinguishing and one for Search & Rescue or one for the crews working on different floors and another for the crew at ground level and the crew trying to make the staircase hall smoke-free.
- As soon as multiple chief officers are active, there should be a separate channel for chief officers to communicate with each other

As a result, chief officers have to listen to two radio's. That is not so easy. Each chief officer listens to a channel with one of the functions (extinguishing, Search & Rescue,…). Moreover, they also listen to the channel at which the intervention is coordinated.

4.4 Incident Command System

One chief officer can control three pumper trucks. As soon as there are more, actually a second chief officer is needed. If those chief officers are then deployed in a different place, or have to overview two completely different things, then a third chief officer is necessary.

In the event of a serious high-rise building fire, two command posts will be set up: one at ground floor and one near the fire floor (n-2). Both chief officers will have to deal with managing their sector. This means that there must be support for those chief officers in both places. A radio operator and someone who keeps track of the situation on one or more whiteboards is actually a minimum.

Image 11 View at the living room of the apartment. There is a lot of smoke damage in this room but nothing really burnt here. The fire was in the bedroom, where two firefighters are heading in the back of the picture. *(Picture: Robert Decock)*

The two command posts must keep a good overview of the various assignments that are in progress. They need to know which crews are carrying out those tasks. Each chief officer has teams at their disposal. The two chief officers then communicate with an incident commander, the third chief officer. The latter can communicate with dispatching, request additional units, allocate these resources to one of the sectors when they arrive, open an additional sector (geographical or functional), have units placed on standby, …

Better management of the intervention will ensure that work is done more efficiently. Clearer management will also lead to fewer frustrations.

5 Conclusion

This high-rise building fire was quite a challenge for the Brussels fire department. A lot went wrong and Murphy came by more than once. Such interventions are – at that moment itself – frustrating for the people who carry them out.

In the aftermath of the intervention, adj. Willy Van Caer, the calm stronghold of the 11th company, with a very important approach. He noted that 5 years ago there was no transitional attack at the Brussels fire department. Mobile risers were not used and the cooperation between teams from different stations was not nearly as good as it was now.

This was a very wise approach. It is important that we look critically at the present to make improvements for the future. However, it is equally important to occasionally look to the past. In this way we realize that we are constantly making progress and that we should not be too hard on ourselves.

6 Resources

[1] *Peter Roseleth, Willy Van Caer and Eric Schmit, fantastic colleagues to work with*

[2] *The other colleagues of the 10th Company that were on scene.*

Karel Lambert