



Image 4: Burning ceiling in the Lame Horse Club; Image taken from [57]

Identified Critical Factors

The nightclub did not fulfil the required safety standards and therefore operated illegally. The pyrotechnic display that was used was certified only for outdoor use. The choice of materials led to an easy ignition and a rapid spread of fire and smoke. There was no evidence of a detection and alarm system, an automatic suppression system, a smoke and heat control system or fire extinguishers. The rear emergency exit was not signed and ordinary occupants did not know about it. The full width of the main entrance was not available as the second leaves of the door were initially sealed.

3.3 Santika, Thailand, 2009

During a New Year's Party on the night from December 31st to January 1, 2009 a fire occurred in the very popular nightclub "Santika" in Bangkok, Thailand. The fire began due to the use of pyrotechnic igniting combustible material at the stage. The fire killed 66 people and injured 236 [65]. Sources for this incident include an investigation report carried out by the Center of Education and Research on Advanced Fire Safety Science and Technology in East Asia, journal and newspaper articles and video footage.

Description of the Building and the Situation Prior to the Fire

The nightclub was a free standing steel-framed building with two stories above and one storey below the ground [65]. The inside of the club was divided into three main areas. The separated VIP area consisted of two stories and a staircase in the area itself. The entrance to the VIP area was at the back of the south side terrace. Another main area was the mezzanine level above the seating area. From the U-shaped mezzanine level people could look onto the stage and the seating area. The third area was the actual ground floor [65]. The floor level on the ground floor was uneven. At the centre of the guest area there was a circular shaped area which was lowered by 40 centimetres. The terrace on the east side was raised by 30 centimetres. The whole guest area was 90 centimetres lower than the entrance hall. In order to connect the different levels there were stairs with two to five steps depending on the difference in height.

The building had three major evacuation routes, the main entrance and two 70 cm wide doors leading to the east side terrace [65]. There were corridors behind the stage that could have been used for evacuation purposes but since the fire originated in between the crowd and the alternative ways of evacuation it would have been very difficult to exit there without a member of the staff who was familiar with the building. On the east side there were six tall and 70 cm wide windows. The height is not specified. Two of these windows served as doors and were part of the major evacuation route. The investigation report is not clear on the condition of the other eastern windows. In the text it says that they did not have a handle to open, but that the glass was broken and the windows used to escape. The layout presented in the report indicates that they were iron barred. There was a lobby leading to the southern terrace. On the south side there were four windows that were secured with iron bars and could not be used for evacuation. There were several windows on the east and south side on the mezzanine level but they were secured with iron bars as well and could not be used for evacuation either.

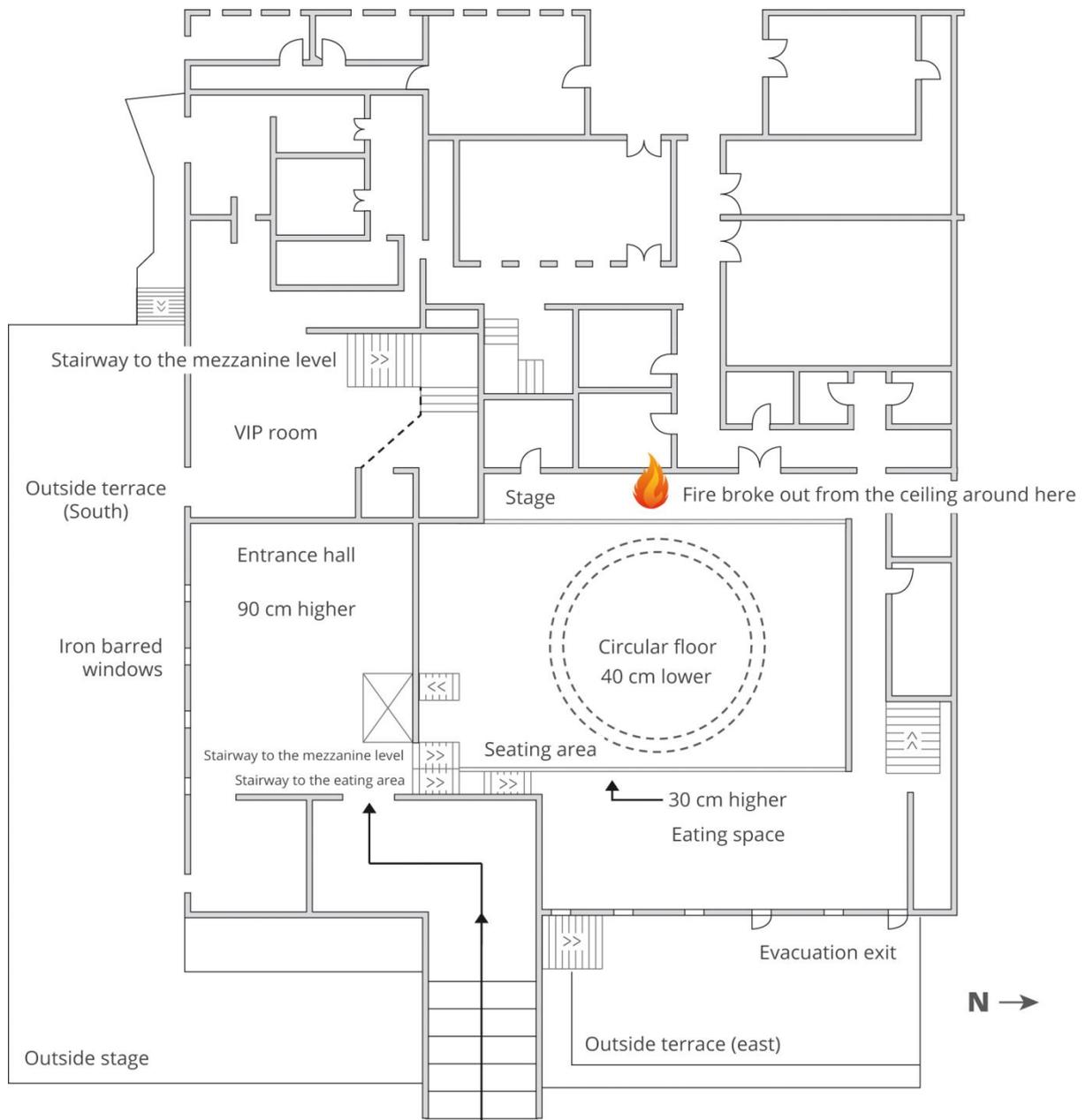


Figure 5: Floor plan of the main floor of the Santika nightclub; The flame indicates the origin of the fire; Figure based on [65]

There were several tables placed in a semi-circular way around the lowered centre of the guest area [65]. Small counters for drinks were placed close to each other. The connection from the seating area to the main entrance was narrow, enough for normal use, but not wide enough for an evacuation.

The following image gives an impression of what the nightclub looked like. It should be mentioned that the picture was most certainly not taken on the night of the incident. In the video of the night no tables in front of the stage can be seen [66].



Image 5: An impression of the area around the stage of the Santika nightclub; Image taken from [67]

The nightclub had only a few lighted exit signs and no emergency lighting. The building was not equipped with a detection and alarm system, an automatic suppression system or a smoke and heat control system. The building was equipped with several fire extinguishers.

It was estimated that 1000-1200 people were in main area of the club [65], [68]. According to [68] the maximum number of occupants based on the NFPA 101 Life Safety Code would have been 898. Reports describing the area as "densely packed" testify to the fact that the venue was overcrowded. At the time Thailand's regulations did not specify occupancy limits [68].

During an investigation carried out by the Ministry of Justice it was found that the building was licensed as a residence and not as nightclub [68], [69]. For residential buildings, fire safety inspections were not required at the time. The club therefore operated illegally. In 2004 the owners of the nightclub "[...] had applied for a license to operate as an entertainment venue [...]", but were refused by the police. From June 2004 until 17th September 2006 the police filed 47 charges against the nightclub. After this date there were no further charges. Since then one of the shareholders of the company was a senior police officer. There is no evidence of bribes being paid or that the senior police officer used his position to hinder police action against the Santika.

Description of the Incident and Human Behaviour

The fire started minutes after midnight due to a pyrotechnic display on stage which ignited the combustible materials near the ceiling [65]. There were no attempts to fight the initial fire or give guidance for the evacuation. The fire and smoke spread rapidly to the sides of the venue. People became aware of the severity as they felt the radiant heat and saw a cloud of black smoke. Soon after the fire broke out there was a power failure and the lights in the nightclub went out. Since the venue had no emergency lighting and there were only a few emergency exit signs, people had difficulty finding the exits. In the first seconds of the fire people believed that it was part of the show. A few people however, including the performers started to evacuate immediately. A while later “[...] a chandelier with a diameter of nearly 10 meters fell down [...]” from the ceiling and crushed a considerable number of people in front of the stage to death [65]. The exact number is unknown. The chandelier can be seen intact in Image 5 and as debris in Image 7.

The VIP room was located close to the stage and burned down very quickly [65]. The evacuation route from the VIP room was obvious, directly leading to the terrace and not many victims were found here. Since the windows on the mezzanine level were secured with iron bars the occupants had to use the staircase leading to the entrance hall. There, the flow of people merged together with those coming from the area in front of the stage. The evacuation was slowed down by the complex geometry of the venue as well as by the furniture obstructing the escape. An unknown number of people locked themselves into different rooms on the ground floor and tried to prevent the intrusion of smoke into their shelter. This worked and they were saved by the rescue service.

The staircase leading to the entrance hall where several egressing flows merged resulted in a bottleneck [65]. Thirty-two fatalities were found around the main entrance [68]. In total 55 out of 66 people died in the building while the other 11 died at a later stage.

The fire was reported to a police station at 00:20 a.m. while the first rescue service received calls at 00:40 [68]. Due to heavy traffic they did not arrive before 00:48 a.m. When the fire fighters arrived, they were unable to access the site immediately, as numerous taxis and patrons in their cars blocked the entrance.



Image 6: The staircase leading to the entrance hall of the Santika nightclub; Image taken from [65]

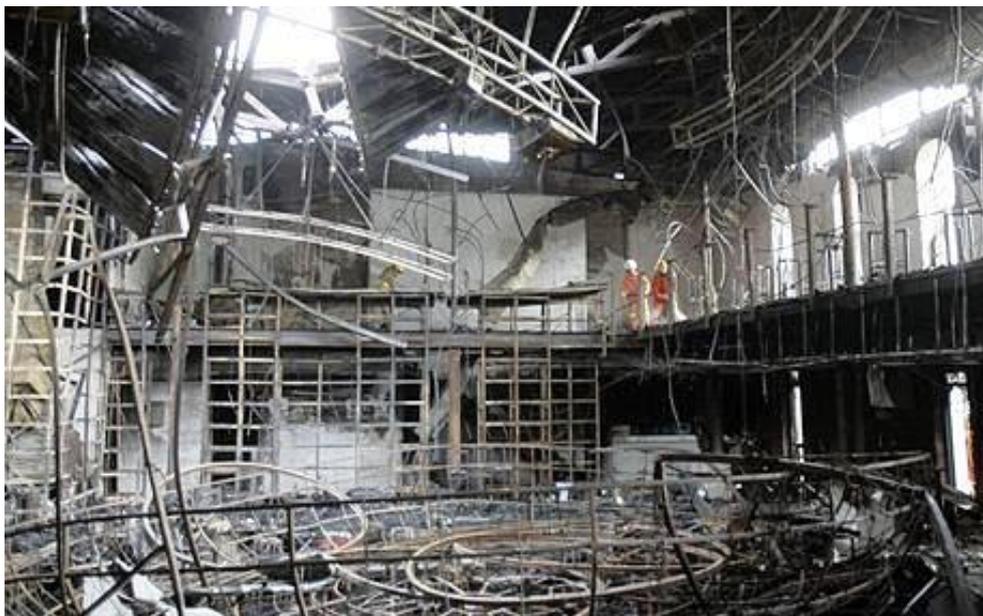


Image 7: The area around the stage of the Santika nightclub after the fire; Image taken from [70]

Identified Critical Factors

The nightclub was licensed as a residence; therefore operated illegally and did not fulfil the fire safety requirements. The fire started due to the pyrotechnic display and was able to spread so rapidly because of the materials used at the ceiling. There was no fire alarm, automatic

suppression system or smoke and heat control system. The main area of the nightclub was overcrowded. The means of escape were not sufficient for the number of people. This is especially true for the main entrance. Additionally, tables and drinking counters obstructed the evacuation. Shortly after the fire started the lights went out. Since the nightclub did not have emergency lighting and only few lighted exit signs, the occupants had difficulty finding the exit. The evacuation itself was complicated by the complex and uneven design of the building. A huge chandelier fell from the ceiling and killed an unknown number of people. Furthermore, the fire and rescue work was delayed. The fire department was alerted 20 minutes after an emergency call had reached the local police station.

3.4 Luna, Scotland, 2009

On January 1st 2009, during a New Year's party, an incident happened in the "Luna" nightclub in Edinburgh, Scotland. Nobody died and only three people were mildly injured by falling melted plastics. There was no need to take them to the hospital. Since no major damage occurred there are not many sources for this incident. It is still interesting to do a short analysis because of the human behaviour that was captured on a video [71]. Due to the limited information, the structure for this analysis is different.

The nightclub was equipped with a fire alarm, but besides that one can only speculate about fire safety precautions. On the particular night there were 400 occupants in the venue [72]. No overcrowding was mentioned.

According to the newspaper, indoor pyrotechnics set fire to the plastic netting on the ceiling shortly after midnight. The plastic melted and dropped to the floor. The occupants did not seem to be impressed by the events and continued dancing. People were singing the anthem "the roof is on fire" [71]. Some were walking right through the falling debris. The fire alarm sounded 1 minute and 11 seconds after the video started. It is unknown how long the fire burned before the video was recorded. Most people kept a minimum distance to the falling debris, also as the fire spread and the debris covered more and more of the floor area. After 2 minutes and 30 seconds, two people, presumably staff, instructed the occupants to leave. People seem to follow these instructions. Apparently the configuration of the nightclub, especially concerning materials, prevented the fire from spreading rapidly. The fire growth