Apartment fire causing the death of five people in Vantaa on 8 October 2023

Y2023-02

FOREWORD

Under section 2 of the Safety Investigation Act (525/2011), the Safety Investigation Authority, Finland decided to initiate an investigation into the fire that occurred in an apartment in Hakunila, Vantaa on 8 October 2023 and led to the death of five people. The purpose of a safety investigation is to promote general safety, prevent further accidents and incidents, and prevent damage caused by the accidents. Safety investigations are not conducted to allocate legal liability.

Senior Safety Investigator Heikki Harri was appointed as the Head of the Investigation Team and experts Jouni Kujala, Jukka Seppänen, Kari Ylönen and Chief Safety Investigator Timo Naskali as members. Chief Safety Investigator Kai Valonen served as the Investigator-in-Charge until 29 February 2024 and Timo Naskali as of 1 March 2024.

Professor of Fire Safety Technology Simo Hostikka from Aalto University acted as the team's advisor in matters related to the ignition of wood. The forensic investigation of the sauna heater was conducted at the Eurofins Expert Services Oy laboratory and at SGS Fimko Oy. Material research of the sauna heater was carried out at the materials and mechanical engineering research unit of the University of Oulu. The forensic laboratory of the National Bureau of Investigation issued a statement on the wall panel coating submitted for investigation.

The safety investigation examines the course of events, its causes and consequences, and the search and rescue actions as well as any actions taken by the authorities. The investigation specifically examines whether safety had adequately been taken into consideration in the activity leading up to the accident and in the planning, manufacture, construction and use of the equipment and structures that caused the accident or incident or at which the accident or incident was directed. The investigation also examines whether the management, supervision and inspection activity have been appropriately arranged and managed. If necessary, the investigation also examines possible defects in the provisions and orders regarding safety and the authorities.

The investigation report includes an account of the course of events of the accident, the factors leading to the accident and its consequences. It also includes safety recommendations addressed to the appropriate authorities and other instances regarding measures that are necessary in the interests of the promotion of general safety, the prevention of further accidents and incidents, the prevention of damage and the improvement of the effectiveness of the operations of search and rescue and other authorities.

The parties involved in the accident and the authorities responsible for supervision within the field of the investigated accident have been provided with the opportunity to provide a statement on the draft investigation report. The statements were taken into account when the report was finalised. A summary of the statements is at the end of the investigation report. Pursuant to the Safety Investigation Act, statements from private individuals are not published.

The investigation report has been translated into English by Lingsoft Oy. The investigation report and its summary were published on 11.7.2025 on the Safety Investigation Authority's website at *www.turvallisuustutkinta.fi*.

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Cover image: Safety Investigation Authority

CONTENTS

1 THE INCIDENT

1.1 Course of events

The family of six was living in the apartment affected by the fire. They lived on the first floor of the apartment building located in Hakunila, Vantaa. The family included the mother, father and four children between the ages of two and seven.

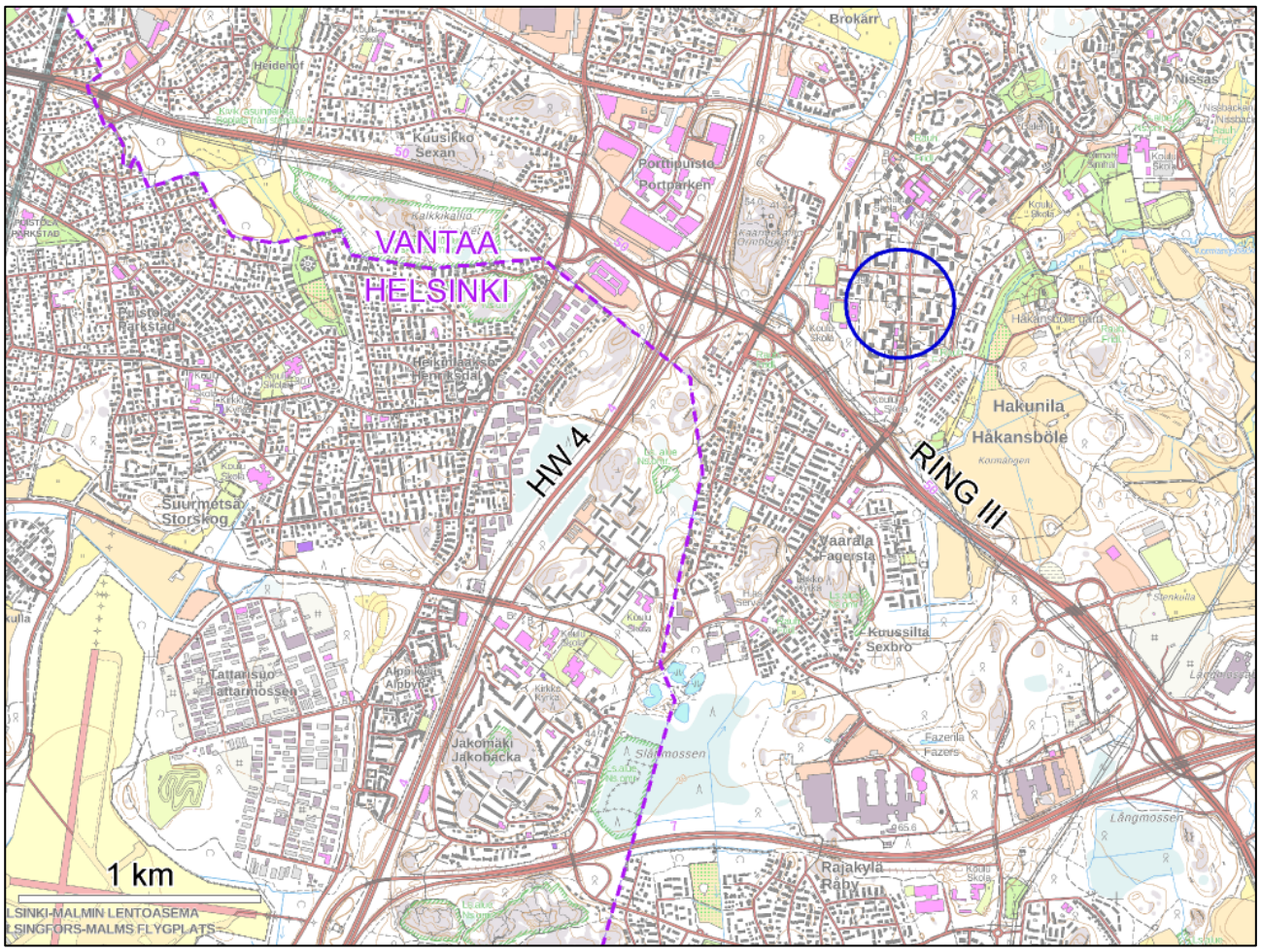

Figure 1. The fire occurred in Hakunila, Vantaa east of the intersection of Ring Road III and Highway 4. (Base map: Basic map raster, open data, © National Land Survey of Finland 03/2024, drawings Safety Investigation Authority)

On Saturday 7 October 2023, the family's father returned home at about 21:00. At the time, the mother had already put the children to bed and was also getting ready to go to bed. The children slept with their mother in the parents' bedroom, which was customary for the family on weekends. The door between the bedroom and the living room was open. The father stayed up until he went to sleep in the middle bedroom before midnight. He closed the door.

At about 0:50, the electric sauna heater in the apartment's sauna was switched on by timer. About two hours later, a fire broke out in the sauna. Oxygen for the fire came through the gap under the glass door of the sauna and the fresh air vent in the ceiling of the sauna. The fire load consisted of the panel walls and ceiling as well as the benches and some clothes spread on them. Smoke spread from the sauna room to the side of the shower room from the gap between the glass door and the door frame.

As the temperature in the upper part of the sauna rose, the glass door shattered, and the fire spread to the shower room. The door between the shower room and the hall was closed, which slowed down the spread of smoke to the rest of the apartment. Smoke first spread from the shower room to the rest of the apartment through the gap between the door and door frame. When the fire had burned through the upper part of the door, the spread of smoke increased.

A resident living in an apartment on an upper floor of the building entered the stairwell from outside and heard the smoke alarm. The sound was echoing in the hallway, and the resident could not tell right away where the sound came from. They located the sound to the right apartment and kept listening behind the door for about half a minute. As they heard no other sounds, they thought it was not a question of an emergency situation, but that someone was cooking, for example. They went home.

The mother of the family was probably awakened by the smoke alarm. She started waking up the children and possibly dressing them up in their day clothes.[1]

The father of the family woke up at 3:15[2] when he heard some kind of an alarm. First, he thought it was the alarm clock but soon realized it was the smoke alarm. He also heard the mother of the children yelling something but could not figure out what she was saying.

The father opened the door of the bedroom and got smoke into his eyes. It was hard for him to breathe. He saw the light in the kitchen and checked that nothing was burning on the hob. Because of the smoke, the father had to leave the apartment. It was difficult to navigate to the door of the apartment, and he had to feel his way out along the walls. He no longer heard the voices of other family members. The father left the apartment. The doors of the apartment were left open, and smoke started to spread into the stairwell.

Outside, the father was incapacitated for a while because of the smoke he had inhaled. When his breathing had returned to normal, he started knocking on the windows and doors at the ground level of the building to get help.[3] He could see that there were flames behind the sauna window of his apartment. At the building parking lot, the father ran into a person whom he asked to call for help.

1.2 Alarms and rescue operations

The **Kerava Emergency Response Centre** picked up the first emergency call about the building fire at 3:21:27. The call was made from an apartment on an upper floor in the same stairwell. The call revealed that there was smoke in the stairwell and that smoke was also getting into the caller's apartment. The caller did not have any detailed information on the situation. The duty officer of the emergency response centre urged the caller and the children in the apartment to move to the apartment's balcony.

Based on the risk assessment made at the emergency response centre, the assignment was classified as a building fire of medium severity in the urgency category B. The first alarms were made at 3:22:23, at which time the following rescue services units received the alert:

- fire officer on duty RKU33 (Rescue Centre, Aviapolis)

[1] This could be concluded from the fact that the children had some daytime clothes, such as jeans, on when found.
[2] The father's phone screen was turned on at 3:15.
[3] The rooms on the bottom floor adjacent to the front door are recreational facilities which are vacant at night.

- first response unit[4] RKU1115 (Mittatie readiness station, Itä-Hakkila)
- rescue unit RKU341 (Vaaralan VPK, contract fire brigade)
- heavy rescue unit RKU505 (Kerava-Tuusula rescue station)
- rescue unit RHE601 (Mellunkylä rescue station)
- lifting platform RHE606 (Mellunkylä rescue station)
- water tender RHE503 (Malmi rescue station).

At the same time, police patrols were informed about the fire. One patrol immediately joined the assignment. After alerting the rescue services at 3:24:08, the emergency response centre alerted the first emergency medical care units. The alarm was received by the field commander for emergency medical care EKU61 from Ruskeasanta emergency medical care station and the ambulance EKU6211 from the Havukoski rescue station.

At 3:25, the emergency response centre informed the rescue services units alerted to the site that there was a mother and two children in the apartment. This was the situational picture established by the emergency response centre based on the emergency call.

Six seconds after the start of the first emergency call, the person the father of the family had encountered at the parking lot called the emergency response centre. This person started the call, but passed the phone to the father. He said that his wife and children were inside the apartment and could not get out. The father also stated that the fire was situated in the sauna of the apartment. The number of children present in the apartment was not evoked during the call.

The emergency response centre relayed the situational information received from the calls at 3:27 to the units on their way to the site. The centre mentioned, among other things, that at least some children were still inside the apartment. The seven other emergency calls made slightly later did no longer provide the emergency response centre with any essentially new information. According to the calls, smoke had spread to several apartments. The emergency response centre told callers not to go into the stairwell filled with smoke and, if necessary, urged them to move onto the balcony. On the background of the calls, it is possible to hear how chaotic the situation was and distinguish some cries for help, for example.

The **first authority** to arrive at the scene was a police patrol of the Eastern Uusimaa Police Department that had been patrolling nearby. It arrived at about 3:36. There were a lot of people in the yard who were gesticulating towards the building. The situation was chaotic. A lot of smoke was billowing out from the windows and the door to the stairwell. The police assessed the possibility of helping those inside the apartment but found it impossible. The police checked the balcony, but there were no people there. The police informed the emergency response centre, and the authorities alerted to the scene that there was a lot of smoke and no one was seen on the balcony. The police ordered people to stand back from the site to make room for rescue vehicles.

[4] The first response unit is a unit manned by two firefighters. The unit's extinguishing water tank and water pump are part of the ultra-high-pressure system (UHPS). It makes the water carried in the tank suffice for effective first response fire-fighting. In larger fires, the unit carries out first response firefighting measures and performs the initial survey so that efficient firefighting can begin as soon as the rescue unit arrives. The Central Uusimaa Rescue Department has designated the stations where the first response units are posted as readiness stations.

Figure 2. The door leading from the living room to the balcony served as the emergency exit from the apartment. (Photo: Safety Investigation Authority, Finland)

The first **Rescue Services** unit to arrive at the scene was the first response unit RKU1115 at approximately 3:29. The impression the unit had gotten from the information provided by the emergency response centre was that there was a mother and children inside the burning apartment. By the door to the stairwell, the father of the family told the rescue workers that his wife and four children were still inside. A team of two firefighters from the unit put on their compressed air breathing apparatuses and reconnoitred the stairwell of the building. There was a lot of smoke in the stairwell and hardly any visibility. The door to the apartment was open. There were no flames to be seen. The team found that it was not possible to proceed to the apartment without extinguishing water.

Based on the information provided by the emergency response centre, the field commander for emergency medical care was also under the impression that, at the site of the accident, a mother and two children had rescued themselves onto the balcony. Upon his order, the emergency response centre alerted another ambulance EKU6233 to the site from the Havukoski rescue station at 3:30. The information received by the first response unit on five persons inside the apartment did not reach the field commander.

The family's father, who was wearing very little clothes and no shoes, was directed to the police car to warm up. The father told the police that there were a mother and four children inside. The police patrol reported this information at 3:31 in the multi-authority voice communications group of the public authority network (Movi1). This information did not reach the field commander for emergency medical care.[5]

[5] The terminals used by the field commanders have several voice communications groups with different levels of priority. Some of the communications may be left under a stronger voice communications group.

The second Rescue Services unit to arrive at the scene at about 3:32 was the rescue unit RHE601[6]. The staff of the unit carried out the initial line placement[7] up to the front door of the building. The unit's foreman and a team of two firefighters smoke-dived[8] into the stairwell, where they met the team of two from the first response unit. All five firefighters continued to dive into the apartment. As their advancing tactics, they decided to move along the left wall of the apartment. The visibility in the apartment was non-existent because of the large amount of smoke. The firefighters did not detect the fire in the sauna and shower room on the right side of the hall.

On the order of the fire officer on duty, at 3:34 the emergency response centre alerted the rescue unit RKU101 from the Havukoski fire station to arrive at the scene.

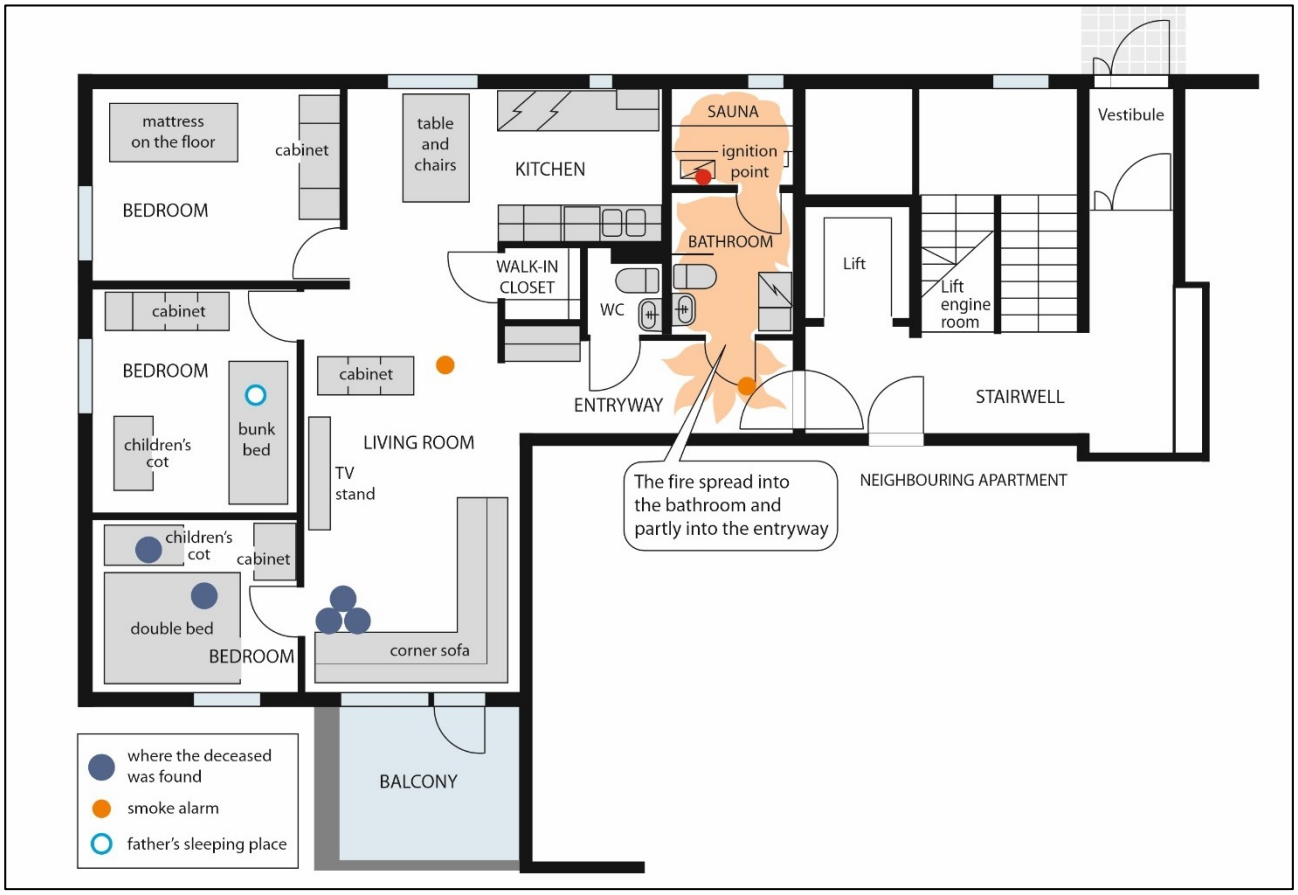

Figure 3. The floor plan of the apartment. (Image: Safety Investigation Authority, Finland)

The smoke divers found the family's mother in the living room, and two smoke divers carried her out. The ambulance EKU6211 was on the yard. The smoke divers handed over the mother in the care of the paramedics of the ambulance and immediately returned to the apartment. At the same time, one child was found in the living room and carried out by one smoke diver. The

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6 The strength of the rescue unit was 1+5, i.e. it had a foreman and five firefighters. One of the firefighters was a driver/engineer and four were smoke divers, forming two teams.

7 In the initial line placement, the primary hoseline from the unit's pump is typically stretched close to the door of the building. At the end of the initial line, a dividing breeching is fitted. From this, 1 to 3 pressurised hose lines can be stretched. In smoke diving, the work team uses a hose line to extinguish the fire and protect their own activities.

8 Smoke diving means firefighting and search and rescue indoors in a building or some other closed indoor space which is on fire and develops dense smoke. Smoke diving is the process of entering a smoke-filled space in firefighting gear wearing a compressed air breathing apparatus, carrying a pressurised water hose with a nozzle at the end.

second ambulance that had arrived at the yard was EKU6233, and the paramedics in the vehicle took the child in their care.

The smoke divers found another child in the living room near the bedroom door and a third child on the double bed in the bedroom and a fourth child in the cot. They were all carried out. The second and third child were taken to EKU6233 and the fourth one to EKU6211. Some of the smoke divers stayed to assist in the care of the children. At 3:42, the field commander for emergency medical care raised the urgency of the assignment to urgency category A and ordered the emergency response centre to alert two more ambulances and the medical helicopter EFH10 to the scene.

In the apartment, the smoke divers opened the door of the balcony and the kitchen window, which quickly improved the visibility. The fire was found to be in the sauna facilities, and it was extinguished. To ensure the safety of those on the upper floors, it was necessary to remove the smoke from the stairwell. It took some time for the smoke divers to locate the release of the smoke ventilation hatch in the stairwell. They found it in the stairwell landing between the first and second floors.

The **medical helicopter** crew supplemented its ground unit[9] with additional supplies, equipment and medicines that may be needed to treat multiple patients exposed to combustion gases. The ground unit set off at 3:49. The doctor of the unit was informed that an adult and four small children are still being resuscitated at the site. The doctor asked the emergency response centre to alert the Helsinki medical unit EHE10, which was alerted at 3:55.

The field commander for emergency medical care ordered the emergency response centre to alert two more ambulances to the scene to have the other residents of the building possibly exposed to smoke checked and, if necessary, transported for treatment. By a decision of the field commander, the non-urgent emergency medical care assignments of urgency category D in the area were temporarily suspended. The field commander for emergency medical care in the Hyvinkää region[10] also started to monitor the situation in the Peijas area in case there were any overlapping assignments.

The next ambulances arrived consecutively from 3:54 forward, and each patient was transferred to an ambulance of their own. The EFH10 ground unit was on the scene at 4:00. The doctor of the unit went around from one patient to another and decided that the resuscitation of all of them would continue. The Helsinki medical unit arrived at the scene at 4:11. The resuscitation measures did not lead to the desired outcome. The doctors decided to discontinue the treatment efforts one at a time from 4:22 to 4:32. The father of the family was transported to the hospital by ambulance.

The police patrol informed the police field command of the situation and of the five victims. At this point, the field commander took command of the situation and arrived at the scene. Two police patrols and a patrol of the forensic investigation centre of the police department were alerted to the scene.

The social and crisis emergency services of the Vantaa and Kerava wellbeing services county received an alarm for the assignment at 3:45. The field commander for emergency medical care contacted the social and crisis emergency services, informing them of the

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9 The ground unit of emergency medical care refers to an ambulance or similar vehicle by which medical helicopter crews take up assignments when flying is inappropriate or impossible due to flight conditions or distances.

10 The Central Uusimaa Rescue Department has two emergency medical care areas, Peijas and Hyvinkää. Both areas have their own field commanders for emergency medical care.

situation and asking them to arrive at the scene. The social and crisis emergency services had no overlapping assignments at the time, so three out of the four employees on weekend duty in the night shift were able to take up the assignment. They stayed at the scene for about an hour and were in contact with the residents of the stairwell. Brochures containing contact details of the social and crisis emergency services were distributed to residents.

Some of the apartments in the stairwell suffered smoke damage. The electrical cables in the stairwell were damaged. Their immediate repairs took a few days, during which time there was no electricity in the apartments. One family was put up by their relatives, and three families checked in a hotel with a payment commitment from the social welfare authority. Some families continued to live in their apartments without electricity.

The following Thursday, the social and crisis emergency services organised an information event for the residents of the building in the clubroom adjacent to the stairwell. It was attended by representatives of the social and crisis emergency services, rescue services, emergency medical services and the police. The event was estimated to have been very necessary.

The Somali community helped the father who had survived the fire and his relatives to cope. They and others affected by the incident also received support from the practical nurses and nurses of the Somali community and the Somali Culture Association of Eastern Vantaa. The employees of the Tsempataan project[11] also discussed the accident, especially with young people. At the school of the oldest child of the family, pupil welfare discussed the fire and recovery from it with schoolchildren. In the day-care centre where the smaller children had been in care, the event was handled under the guidance of city employees. The church of the Hakunila parish was open both on Sunday and Monday, with the pastor present. People were invited to light memorial candles in the church's memorial courtyard.

The adult education centre where the mother of the family had been studying received information about the mother's death informally from other students. The adult education centre did not receive official information on the mother's death from the authorities. Due to the informal nature of the information received, the centre could not start processing the matter or initiate crisis work, which it perceived as a difficult issue. More than two weeks after the incident, the Digital and Population Data Services Agency officially reported the student's death to the school during the week of the autumn break. After the break, three weeks after the accident, the adult education centre had the flag flown at half-mast, and a quiet moment was held during the lessons. Students could write their condolences in a sympathy card.

1.3 Consequences

The mother and all four children of the family died in the fire.

Of the other families in the stairwell, five families needed social and crisis emergency centre's services. Some families moved to emergency accommodation.

The sauna and shower room of the apartment where the accident occurred were badly destroyed. The damage to the apartment was so substantial that it was decided that the whole apartment would be refurbished, including the partition walls. The stairwell suffered significant smoke and heat damage. A few other apartments suffered smoke damage.

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[11] Tsempataan! is a project operating in Vantaa with the support of the Funding Centre for Social Welfare and Health Organisations (STEA). The project aims to promote the social functional capacity, well-being and employment of immigrants.

2 BACKGROUND INFORMATION

2.1 Operating environment, equipment and systems

The apartment building was built in 2000. The building has six floors and two stairwells, stairwells A and B. There is a sheltered housing unit in stairwell B. The sheltered housing unit is equipped with an automatic fire extinguishing system and a fire alarm system. Stairwell A includes rental apartments owned by VAV-Palvelukodit Oy[12], the rental of which is the responsibility of the Wellbeing Services County of Vantaa and Kerava, VAKE.

The smoke ventilation from stairwell A has been implemented by means of a window that is opened at the level of the top floor. It is released from the stairwell landing between the first and second floors. There were no smoke alarms or first response firefighting equipment in the stairwell.

The apartment was 86 m^2 in area. It included three bedrooms, a living room, a kitchen with dining area, a walk-in closet, a toilet, a bathroom and a sauna.

The actual exit from the apartment to the stairwell was through a double-leaf door. The outer door leading into the stairwell was a fire door with EI15 fire classification. The inner door was a lightweight flush door. Emergency exit was through the door leading directly from the living room to the outdoor terrace. The apartment had two smoke alarms that had been replaced and equipped with new batteries in connection with the renovation of the apartment in July 2023.

There was a normal amount of **movable property** in the apartment. The living room had a large corner sofa placed so that using the door leading to the balcony would have required climbing over the sofa.

The **sauna** had an area of approx. 5.5 m^3. It had spruce panelling on the walls and ceiling, a glass door and a window. The site investigation revealed that laundry had been spread on the sauna benches to dry. There was an empty pan on the lower bench. The investigation revealed no information on there having been items placed on top of the heater when the fire erupted. Furthermore, the laundry spread on the benches was found not to have contributed to the fire.

The sauna heater was a Harvia Termonator model sauna heater mounted on the wall using a separate wall mounting rack. The mounting rack is made of 0.7 mm steel plate. The vertical sides of the plate are bent in a U shape. They are used to screw the mounting rack to the wall. There is an 18 mm air gap between the panel wall and the mounting rack plate. At the top of the mounting rack, the plate is bent horizontally so that the free opening between the panel wall and the edge of the bent plate is approximately 10 mm.

The heater is lifted to the mounting rack on the wall and locked in place in the horizontal part of the mounting rack with one locking screw at the top of the mounting rack. When the heater installed, the gap between the panel wall and the heater is reduced so that the free opening is approximately 5 mm. The plate-like back of the heater frame and the mounting rack plate are aligned against each other so that there remains a gap of a few millimetres between them. There is a gap between the heater frame and the metal casing limiting the space for sauna stones. The metal casing is curved. The width of the gap is at its smallest, approx. 11 mm, at

[12] VAV Palvelukodit Oy is a subsidiary of VAV Group Oy owned by the City of Vantaa, which builds, owns and manages rental apartments. The accident property and most of the other buildings owned by VAV Palvelukodit Oy are leased to VAKE, which acts as the lessor for the residents.

the back of the heater in the middle. In the corresponding spot at the bottom part of the heater, the gap is more than 20 mm wide.

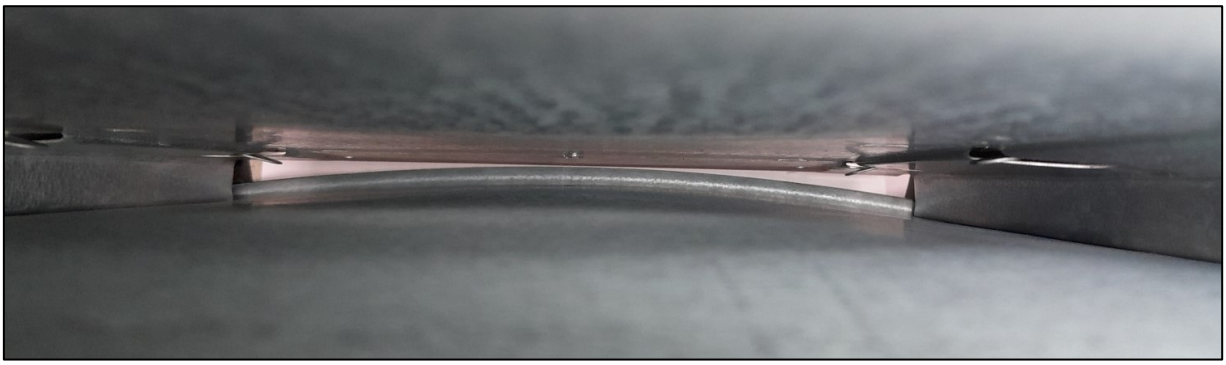

Figure 4. The photo shows the gap between the stone space and the heater frame. The plate-like back of the frame on top of the photo and the curved stone space on the bottom. There is a bent collar at the top of the metal casing of the stone space, which reduces the free opening. (Photo: Safety Investigation Authority, Finland)

The information on the year of manufacture of the sauna heater could not be read on the type plate after the fire. Its year of manufacture was obviously close to the year when the building was constructed. The heater had a nominal output of 6 kW. According to the sauna heater's instructions for installation and use[13], this was a suitable output level for a sauna room of this size with a glass door and a window. The heater had been installed according to the instructions for installation and use.

TYP	D min. mm
M45/M45E	115
M60/M60E	130
M80/M80E	180
M90E	200

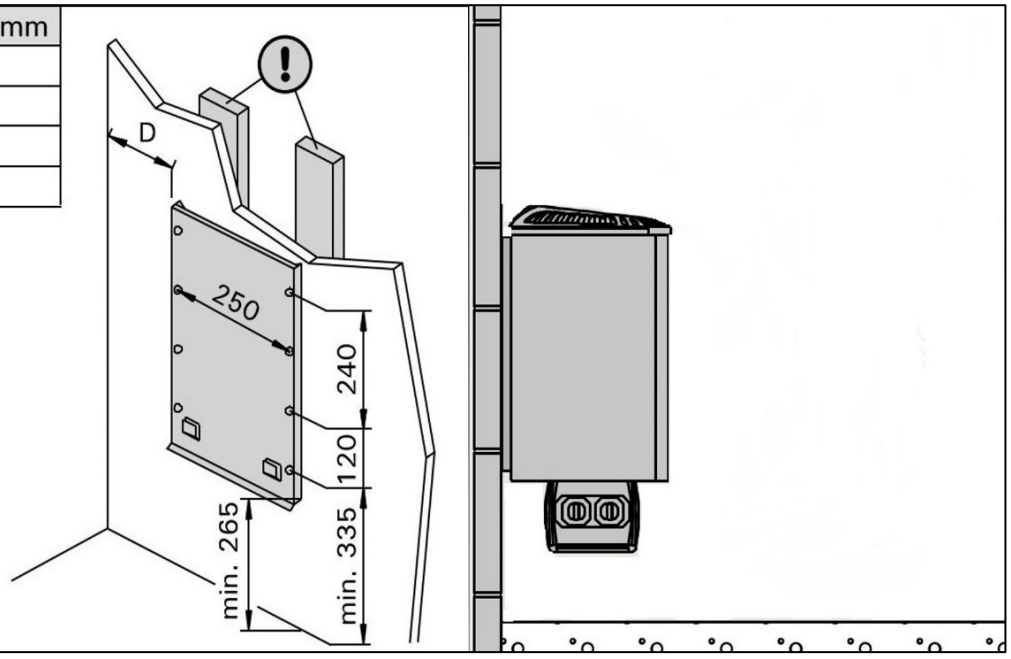

Figure 5. The image shows the installation instructions for the mounting rack on the left and the sauna heater mounted on the wall using the mounting rack on the right. (Images: Harvia)

[13] All references to the instructions for installation and use of the sauna heater refer to the 2003 instructions unless otherwise mentioned.

Around the top edge of the sauna heater, there was a cast iron collar, the air flow spoiler. The visual examination of the heater revealed deformations in the casing of the heater's stone space, so that the casing had outward dents.

Figure 6. In the photo on the left, the burnt heater after it was re-electrified and on the right the controls of another heater of the same age. The heater in the photo on the right is in the sauna of another apartment in the same building. (Photo: Safety Investigation Authority, Finland)

Instructions concerning **sauna stones** are provided in the instructions for installation and use of the sauna heater. Only high-mass stones specifically intended for sauna heaters may be used in the heater The instructions describe how to fill the stone space correctly and prohibit the use of ceramic stones and soapstone. Stones must not be piled too tightly so as not to obstruct air flow through the heater. The sauna stones disintegrate in use. Therefore, they must be rearranged at least once a year or even more often if the sauna is in frequent use. At the same time, any pieces of stone accumulated at the bottom of the heater must be removed and disintegrated stones replaced with new ones. The warranty does not cover any defects if they are caused by stones crumbled in use or too small stones blocking the air circulation of the heater. No such objects or devices should be placed inside the stone space of the heater or in its immediate vicinity that could change the amount or direction of the air flowing through the heater, as this could cause overheating of the heating elements and a fire hazard to the wall surfaces.

The same section of the instructions for installation and use published later for another sauna heater model by the same manufacturer[14] explains the need for the measures above by keeping the heating capacity of the heater optimal and avoiding the risk of overheating.

The investigation did not clarify whether the sauna stones had been replaced. There is no documentation on the stones having been replaced. The property's maintenance programme

[14] https://pim.harvia.com/rockon-images/CIP/asset/download/3c5b6375-efcf-42bf-86ea-4ff1ab4796a9/826

did not include any repair or maintenance measures related to the sauna heater, so any maintenance needs were only responded based on fault reports.

The **electric controls of the heater**, i.e. the timer switch and thermostat, were in their own housing at the bottom of the heater. They could be changed from right-handed to left-handed or vice versa, that is, looking from the front, they could be installed on the left- or right-hand side of the heater.

The purpose of the thermostat is to keep the temperature of the sauna stable. When the thermostat's temperature sensor reaches a predetermined temperature, the thermostat cuts off the current from the heating elements and they start to cool. When the temperature of the temperature sensor has dropped to a predetermined temperature, the thermostat activates the heating elements again. The thermostat of the heater also has an overheat protector. According to the instructions for installation and use, the overheat protector acts as a safety device, permanently cutting off the supply of electricity to the heater if the temperature in the sauna room becomes dangerously high. The thermostat and overheat protector sensors were mounted on top of the housing for the controls.

According to the instructions for installation and use, it is perfectly normal for the wooden surfaces, such as panels, of the sauna room to blacken in time. The blackening may be accelerated by sunlight and heat from the heater. If the wall surfaces have been treated with wood protection agents, the wall surfaces above the heater may begin to blacken quite quickly, depending on the protection agent used. This is due to the fact that protection agents have a lower heat resistance than untreated wood. This has been proven by practical tests. Even fine particles disintegrating from the sauna stones which rise with the air flow may darken the wall surface in the vicinity of the heater.

According to the instructions, the sauna heaters do not raise the temperature of the combustible materials in the sauna room dangerously high when the heater is installed in accordance with the approved installation instructions issued by the manufacturer. The highest allowed temperature on the wall and ceiling surfaces of the sauna room is +140 °C.

The positions of **the controls of the burned heater** could be verified with sufficient certainty by means of reference pieces and X-ray examination.[15] At the time of the fire, the thermostat switch was nearly in the maximum position. The time remaining on the timer control for the heater to remain active was approximately an hour and a half. The timer had stopped after the power supply was cut off due to the fire. The overheat protector had not gone off.

[15] The investigation of the controls was conducted by Eurofins Oy.

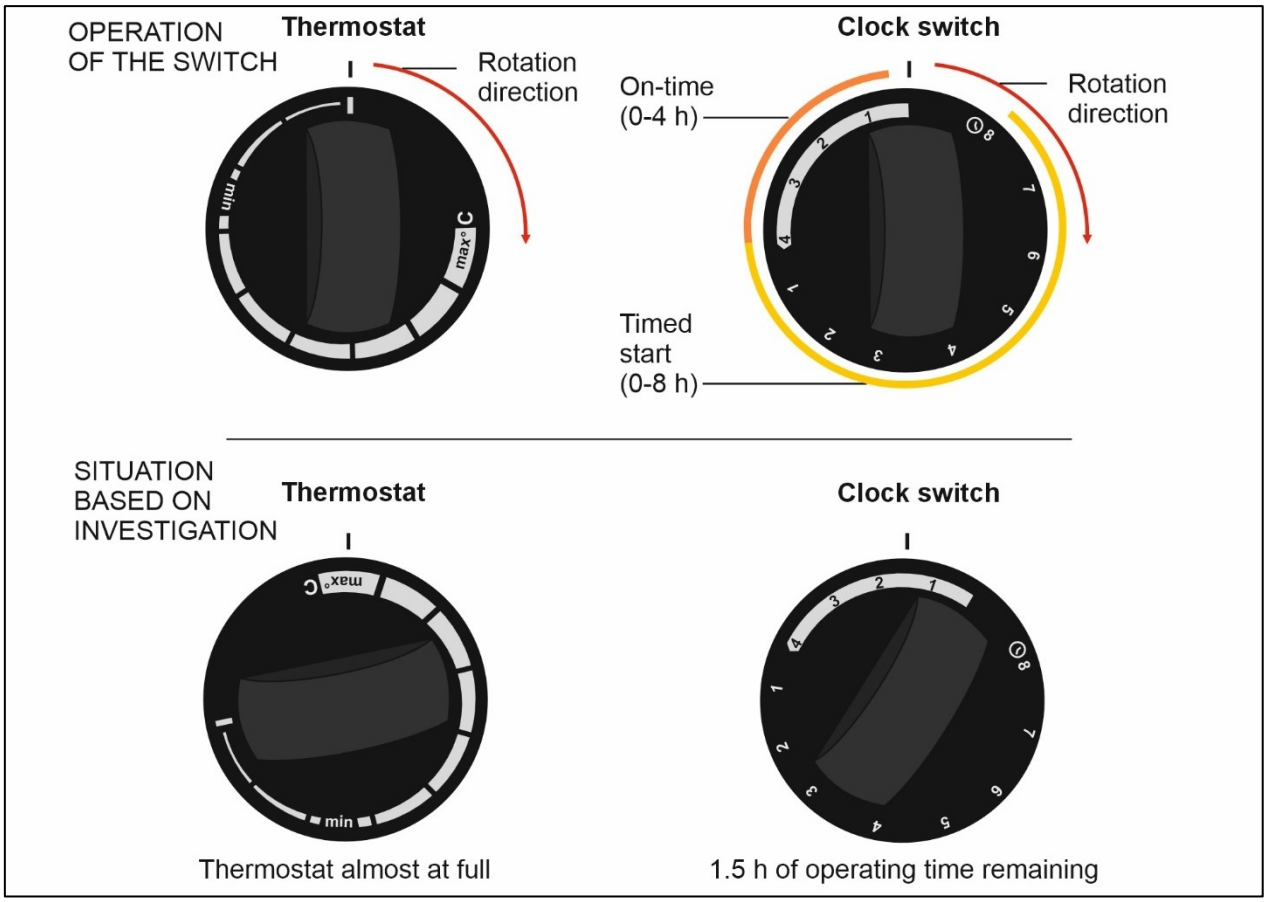

Figure 7. The image shows the basic functions of the controls and the positions of the controls at the time the power was cut off based on the investigation. (Image: Safety Investigation Authority, Finland)

The timer switch of the heater had probably been turned clockwise at some point late in the afternoon or in the evening so that the switch had remained in the timer preselection area for timed switch-on. At the earliest, the timer switch could have been activated at 16:50, at which point the timer would have been turned to its most extreme position.

Other technical examinations performed on the heater are described in section 2.8.

2.2 Conditions

It was dark outside, and the outdoor temperature was +4°C.

2.3 Recordings

The investigation team had access to the recordings of the emergency calls received by the emergency response centre. It also had the radio traffic over the Finnish authorities' telecommunications network VIRVE, recorded by the Emergency Response Centre Agency, at its disposal. Radio traffic recordings included radio communications of the rescue services, the police, emergency medical care and other authorities.

The rescue department provided the investigators with the radio traffic recordings made by the situation centre and the camera recordings of the vehicles involved. With the help of the recordings, it was possible to determine, among other things, the exact times of different events.

The investigation team could also use the apartment's electricity consumption data. Based on the information, it was possible to conclude that the sauna heater had switched on at 0:50. According to the consumption data, the electricity in the apartment was cut off at about 3:20. The time when the heater had switched on and the heating time remaining in the timer after the electricity had been cut off corresponded to timed switch-on of the heater.

Three mobile phones that had been in use were found in the apartment, two of which provided information on their use. According to the father's phone usage information, the screen of the phone had been turned on at 3:15.

2.4 Persons, organisations and safety management related to the accident

The father of **the family** moved from Somalia[16] to Finland in 1993 and is a Finnish citizen. The father has reduced mobility. The mother of the family was born in 1990. She was literate and trained as a nurse.[17] In addition to her mother tongue, Somali, the mother also spoke Arabic. She came from a small built-up area in Central Somalia, where she had lived in a modest single-family stone house.

The couple met each other in Somalia in 2013 and married a few years later. The first two children of the couple were born abroad in 2016 and 2017 respectively. As the mother was the spouse of a Finnish citizen, she was issued a continuous residence permit for one year in December 2018. She moved to Finland with her children. Her residence permit was extended by four years. Two more children were born in the family in 2019 and 2021 respectively. In August 2023, the oldest child started school and the second oldest preschool. The two smaller children went to day care in a day-care centre.

As the residence permit had been granted on the basis of family ties, no integration plan was drawn up for the mother and she did not participate in integration training. She had an unlimited right to work, but she was not working due to the small children at home. The mother had studied some Finnish. After registering for employment services in autumn 2022, she was covered by the measures laid down in the Act on the Promotion of Immigrant Integration. At that point, an employment plan was drawn up for her at Vantaa Skills Centre[18]. Shortly after that, the mother started her studies at the Vantaa Adult Education Centre in Tikkurila, about four years after moving to Finland. Until then, her familiarisation with Finnish society and culture had taken place in an informal manner, which means that her spouse was practically responsible for it.

The mother's teaching group was a starter group in early-stage studies in adult basic education for immigrants[19]. In addition to Finnish, the students learned mathematics, environmental studies, natural history and social studies. The group also had fire safety-related discussions on smoke alarms, general causes of fire and calling the emergency response centre. It could not be verified by the investigation team whether the mother had attended these lessons. She had had a lot of absences due to her children.

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16 Somalia is a fragile state, which is one of the poorest and most insecure countries in the world. The country has been affected by wars, corruption, natural disasters, drought, etc. Health care is very inadequate. According to UN statistics, Somalia's gross national income in 2021 was only USD 104 per person. 40% of adult population is literate. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/LDC_Profile_Somalia.pdf

17 According to the impression gathered through interviews, the training of Somali nurses primarily corresponds with the qualification of a practical nurse in Finland.

18 Vantaa Skills Centre is a service maintained by the City of Vantaa that provides advice and guidance to immigrants living in Vantaa in the identification of competence, training and education and job search.

19 Adult basic education for immigrants is mainly intended for adults with a short school history or who have previously been unable to participate in school education.

The family took a sauna very rarely. The sauna heater was turned on and off by the father, and the mother had no experience of using the heater controls.

VAV Palvelukodit Oy is a subsidiary of VAV Group Oy, which is owned by the City of Vantaa. The VAV Group-owns, in total, more than 200 properties and 11,500 apartments with approximately 50,000 inhabitants. Almost 3,000 apartments have their own sauna.

The property where the incident happened is owned by VAV Palvelukodit Oy, which has leased it to the wellbeing services county of Vantaa and Kerava. VAV and the wellbeing services county have a table on the division of responsibilities specifying how the responsibilities related to the management and use of the property, turns of use, safety and drawing up contracts are divided. For example, property-level management, maintenance and repairs are the responsibility of VAV, whereas resident selection, apartment-level management and maintenance, as well as residents' services are the responsibility of VAKE. The table on the division of responsibilities does not specifically mention who is responsible for maintaining the heaters in apartments' saunas or replacing sauna stones.

The VAV Group has assigned the responsibility of replacing the sauna heater stones to the tenants since 2019, in the resident instructions on the Group's website. In the responsibility distribution table between the VAV Group and the customers renting directly from it, the responsibility for replacing sauna stones in apartment saunas has been assigned to the residents since 2022.

The **wellbeing services county of Vantaa and Kerava** has approximately 280,000 inhabitants. The wellbeing services county provides social welfare and health care services and rescue services. The county is also responsible for renting the apartments in the property where the incident occurred and guiding the tenants. The county selects the residents based on an assessment of the need for services.

New residents are guided on how to live in the apartments by their own social counsellors. With the tenancy agreement, the residents are sent instructions on matters such as home maintenance. Separate instructions for using the sauna or sauna heaters are not available, but the resident can ask for guidance on using the sauna from social counsellors.

After a resident has moved out, the condition of the apartment is inspected visually, and any deficiencies are acknowledged. The sauna heaters of the apartments are usually not tested because at the time of the inspection there is usually no electricity in the apartments. If anything clearly out of the ordinary is observed in the stone space, it is addressed.

The **housing company's rescue plan** has been drawn up especially for the needs of the sheltered housing unit located in staircase B. The plan mentions faulty electrical devices, cooking, smoking and the use of open fire, such as candles, as possible causes of fire. Fire prevention measures and safety arrangements referred to include anticipation of situations, safety training, regular inspections and addressing any deficiencies.

According to the rescue plan, a 6 kg powder extinguisher is placed on every floor. The principle of escape safety is that it must be possible to exit all premises in a residential building via at least two routes at any time. These exit routes must be accessible at all times. In apartments, a window or an apartment-specific balcony is considered an emergency exit.

2.5 Preventive action by authorities

The latest **fire inspection of the property** had been carried out in September 2020 and the one prior to that in 2017. The inspections were carried out in accordance with the supervision plan of the Central Uusimaa Rescue Department. The focus of the inspection was on the

assisted housing unit in stairwell B, but it also included the inspection of the common facilities in stairwell A. According to the inspection protocol, attention was paid to one thing on the side of stairwell A – the hydraulic door closer of the fire door in the building storage did not work and was ordered to be repaired. In accordance with general operating practices, no fire inspections were carried out in individual apartments.

2.6 Rescue organisations involved in the rescue operation and their operational readiness

The **Central Uusimaa Rescue Department** is responsible for rescue services in Vantaa. Administratively, the rescue department operating in the areas of eight municipalities is part of the wellbeing services county of Vantaa and Kerava. It also provides services for the wellbeing services county of Central Uusimaa. The rescue units of the rescue department are located at ten fire stations, two of which are readiness stations. In addition, there are 30 contract fire brigades in the rescue department area. The department has eight rescue units, three lifting platform units, one heavy clearing unit and one tanker in immediate departure readiness. In addition, two first response units are in immediate departure readiness.

In daily situations, rescue operations are led by two fire officers on duty, one in the southern area and the other in the northern area. The command duties of fire officers are supported by an on-call fire officer who is in 24-hour readiness. In the event of a major accident, the on-call fire officer acts as a general commander at the Rescue Services command centre in Vantaa. The rescue department also has a situation centre operating 24 hours a day that supports rescue operations and their command.

The rescue and readiness stations closest to the site of the accident at Hakunila are the following:

- Mittatie readiness station, Itä-Hakkila 4.1 km
- Havukoski rescue station 7.6 km
- Rescue Centre, Aviapolis 11.7 km.

The nearest contract fire brigade is in Hakunila right next to the site of the accident.

The **Regional State Administrative Agency for Southern Finland** (ESAVI) supervises the access to rescue services in the Central Uusimaa region. In 2017, the Regional State Administrative Agencies conducted a national survey examining the realisation of rescue response times in accordance with the minimum targets set for 2013–2016. There were 66 risk grid squares in the risk category I for rescue services in Central Uusimaa, of which 25 were so-called problem grid squares[20]. According to the survey, the Central Uusimaa Rescue Services area was one of those areas with most shortcomings in the realisation of operational response times in accidents occurring in category I risk grid squares. According to a review conducted by the Regional State Administrative Agency for Southern Finland in 2020, the number of risk grid squares in category I had increased to 96 in Central Uusimaa, and the number of problem grid squares had increased to 56 accordingly. The main reason for the increase in the number of risk grid squares was construction.

In 2020, the Central Uusimaa Rescue Services prepared a decision on the service level of rescue services for 2021–2024. In the view of the Regional State Administrative Agency for Southern Finland, the decision did not sufficiently take into account the significant shortcomings found in the service level and requested a clarification from the rescue services.

[20] A problem grid square refers to a risk grid square in risk category I, where the minimum target set for the operational response time has fallen short of the target in the previous four calendar years.

In December 2020, the Central Uusimaa Rescue Department prepared a plan to improve the operational readiness of rescue services. In its decision[21] in spring 2021, the Regional State Administrative Agency for Southern Finland required that the shortcomings be rectified in accordance with the plan prepared by the rescue department. In practice, rectifying the shortcomings included placing new rescue units in the areas of Myyrmäki, Hakunila, Tikkurila and Korso in 2022–2026.

At the end of 2022, the rescue services notified the Regional State Administrative Agency for Southern Finland that the implementation of the plan would be partially delayed. The new preparedness stations will be constructed in 2024–2026[22].

The **Helsinki City Rescue Department** is responsible for rescue services in the City of Helsinki area. The rescue units of the rescue department are located at 12 rescue stations. The rescue stations located closest to the site of the accident in Hakunila were the following:

- Malmi rescue station 5.9 km
- Mellunmäki rescue station 7.2 km
- Kontula light rescue station (first response unit) 7.3 km.

Rescue units from the Mellunmäki and Malmi rescue stations were alerted to rescue operations related to the Hakunila fire.

The party responsible for organising **emergency medical care** in the Uusimaa region is the HUS Group. In the wellbeing services county of Vantaa and Kerava, the HUS Group has concluded a cooperation agreement with the rescue department, according to which the rescue department is responsible for assignments in urgency categories A to C and for first response tasks. The arrangements are described in the decision on the service level of emergency medical care 2023. Non-urgent emergency medical care tasks in urgency category D and most transfers are provided by a private service provider.

Risks and the concentration of population have been taken into account in the placement of emergency medical care units in the area. Together with Kerava, Vantaa is part of Peijas operating area, which has eight emergency medical care units operating 24 hours a day and two units operating part of the day. The ambulance helicopter Finnhems is available to support emergency medical care units in the area. In cooperation with the emergency response centre, the field commander for emergency medical care is responsible for the most appropriate use of the units and manages emergency medical services around the clock. The physician in charge of emergency medical care is responsible for administrative and financial matters and quality control.

Any support provided by Helsinki must be negotiated with the field commander on a case-by-case basis, but in normal situations, the Helsinki units do not leave their own area. This is based on the high utilisation rate of the City of Helsinki's emergency medical care units. This way, the City of Helsinki aims to secure the city's own preparedness for emergency medical care. At the time of the fire under investigation, there were no free emergency medical units in Helsinki.

The **Eastern Uusimaa Police Department** operates in the areas of 15 municipalities in the eastern and central parts of the Uusimaa region. During the event, the police station closest to Hakunila was the Helsinki Main Police Station in the vicinity of Helsinki Airport.

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21 Decision ESAVI/29014/05.09.01/2020 of the Regional State Administrative Agency for Southern Finland of 21 April 2020.

22 The first readiness station was commissioned in Tikkurila in September 2024.

The **social and crisis emergency services of the Vantaa and Kerava wellbeing services county** are in 24-hour preparedness for major accidents and are responsible for organising psychosocial support in special situations. Emergency crisis services also provide acute crisis assistance in other sudden crisis situations, such as fire, sudden death of a loved one, violence and serious injury or illness. The tasks of social emergency services include situations that require immediate action by the social welfare authority. These include concerns about the conditions or safety of a minor child, domestic violence or the coping of an older person at home.

2.7 Rules, regulations and instructions

2.7.1 Building

According to **building regulations**[23], it must be possible to exit a building safely in case of fire or another emergency. There should normally be at least two exits from each evacuation area of the building. One exit is permitted in a building with a maximum of eight floors, when the purposes of use of the evacuation area include housing. In this case, there must also be an emergency exit route from the evacuation area through which escape is possible independently or through the measures of the fire brigade.

2.7.2 Housing maintenance and rental

Under the **Limited Liability Housing Companies Act**[24], the company is responsible for maintenance that is not the responsibility of the shareholder. The housing company shall keep the building structures and insulating materials of owner apartments in good condition. Moreover, the housing company shall be responsible for the maintenance of systems for heating, electricity, data communications, gas, water, sewer and ventilation and other similar fundamental utility systems. However, the housing company shall not be responsible for sinks, tubs, bowls, basins or other such products located in the owner apartments.

According to the Government proposal[25], the starting point for the shareholder's responsibility for the maintenance is that the shareholder is responsible for the internal parts of the owner apartment and the installations and equipment regarded as fundamental equipment of the apartment to the extent that they are not essential for the operation of the fundamental systems maintained by the company or that they are wearing parts in normal use.

According to the **Act on Residential Leases**[26], at the commencement of the lease and throughout its duration, the apartment shall be in such condition as the tenant may reasonably require, taking the age of the apartment, the local housing stock and other local conditions into consideration, unless otherwise agreed regarding the condition of the apartment.

Kiinteistömedia Oy, owned by the **Finnish Real Estate Federation**, has published several guides related to property maintenance, management and responsibilities. According to the guide *Taloyhtiön vastuunjako*[27] (Maintenance responsibilities in the housing company), the

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23 Provisions on the fire safety of buildings are laid down in a Ministry of the Environment Decree. The decree issued in 2002 was in force during the construction of the building.
24 1599/2009.
25 HE 24/2009.
26 481/1995.
27 Finnish Real Estate Federation, Finnish Real Estate Federation Uusimaa and Kiinteistömedia Oy (2023), 12th revised edition.

sauna panels, benches and heater are the responsibility of the shareholder. The guide does not mention the replacement of sauna stones. The guide *Household's Maintenance Responsibilities* [28] highlights *the most important* maintenance responsibilities of the shareholder and housing company in the apartment, and the *Opas taloyhtiön asukkaille*[29] (Guide to the residents of a housing company) provides answers to the *most common* questions concerning home use and repairs. These guides do not mention the sauna or sauna heater. According to the guide *Vuokra-asunnon vastuunjakotaulukko vuokralaiselle*[30] (Table on the tenant's maintenance responsibilities in a rental apartment) published in 2023, the tenant is responsible for taking care of the sauna heater, and for cleaning and changing the sauna stones.

Publicly available tenancy agreement templates drawn up by several different operators do not mention sauna heater maintenance or changing sauna stones.

2.7.3 Sauna heater

According to the **standard on sauna heating equipment**[31], the stone space in the sauna heater must be filled according to the instructions for use. The heater must have a warning that an insufficiently filled stone space poses a fire hazard. The instructions for use of the sauna heaters must mention how the stone space should be filled. The temperature of the walls, ceiling and floor of the sauna room must not rise above 115 °C.

According to the standard, the sauna heater is also put to a test in which the heater is used in an irregular manner. In this test, the temperature of the walls and ceiling of the sauna room must not exceed 140 °C.

According to the standard, the overheat protector of the sauna heater must cut off the power supply to all heating elements. The overheat protector must be non-self-resetting and operate independently of the thermostat.

The standard addresses common hazards caused by devices that people encounter at home and around them. The standard does not take into account situations in which children use devices without supervision or play with them.

In 2023, amendments and specifications were made to the standard[32], with an aim to increase the safety of electric sauna heaters. A Finnish expert group was also closely involved in the preparation of the changes. An essential change compared to the previous standard is that the heater must have a clear indicator that shows when the heater or delayed switch-on has been activated.

2.7.4 Integration

Under the **Aliens Act**[33], family members of a Finnish citizen living in Finland and minor unmarried children of the family members are issued a continuous residence permit due to family ties. A residence permit applied for due to family ties may only be refused on the basis of a special reason, such as giving essentially false or misleading information.

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28 Kiinteistömedia Oy.
29 Kiinteistömedia Oy.
30 Finnish Landlord Association and Kiinteistömedia Oy (2023), First edition.
31 During construction, the International Standard *60335-2-53 Safety of household and similar electrical appliances - Part 2: Particular requirements for sauna heating appliances 1997-08 applied.*
32 *SFS-EN 60335-2-53 Household and similar electrical appliances – Safety – Part 2-53: 2012 Particular requirements for sauna heating appliances and infrared cabins.*
33 301/2004.

According to the **Act on the Promotion of Immigrant Integration**[34], the integration process includes providing basic information about Finnish society, guidance and counselling, initial assessment, integration plan and integration training. Measures and services promoting integration can be organised as employment and business services, basic municipal services or other measures promoting integration. All immigrants must be provided at least basic information about Finnish society and, if necessary, guidance and counselling.

The **Welcome to Finland guide**[35] contains information on housing, work and authorities as well as basic information about Finnish society. The chapter on safety at home describes, for example, the operation of smoke alarms, the minimum number of smoke alarms and the need to replace their batteries, the risks associated with the sauna and hob, electrical safety and the need for a fire blanket and a hand fire extinguisher. The only instruction concerning the operation of the Emergency Response Centre and the assistance that can be called through it is: "In case of fire, call 112."

The Welcome to Finland guide provides first-stage advice in accordance with the requirements of the Act. The guide is distributed as basic information material to all those moving to Finland, either when they are granted a residence permit or they are registering their right of residence. The guide is available in a written or electronic format in twelve different languages, including both languages (Somali and Arabic) known by the mother of the family who died in the accident.

2.7.5 Operational readiness of rescue services

Under the **Act on Organising Rescue Services**[36], rescue services must be planned and performed so that they can be carried out in the most effective and appropriate way, ensuring timely and effective responses to accidents and dangerous situations.

According to the **Rescue Services readiness planning instructions**[37], to determine the readiness for rescue operations, the rescue services areas are divided into 1 km x 1 km risk grid squares, and a risk category from I to IV is assigned for each of them. In the highest risk category, i.e. risk category I, the goal is that the first rescue services unit will arrive at the site of the accident within six minutes from receiving the alarm. The aim is also that the maximum response time[38] would not exceed 11 minutes. The minimum objective is that in emergency rescue operations the first unit to arrive would reach the target set for the operational response time for the risk grid square in at least 50% of the assignments. In addition, the operational response time for rescue services must be met in at least 50% of the assignments.

2.7.6 Emergency response instructions

Under the **Rescue Act**[39], the rescue services must – in cooperation with the authorities involved in rescue operations that provide executive assistance, and the Emergency Response Centre Agency – draw up emergency response instructions on alerting the resources needed in rescue operations. The emergency response instructions must also take into account the cooperation between rescue departments and the obligation to provide assistance to another

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34 1386/2010.
35 https://tem.fi/en/welcome-to-finland
36 613/2021.
37 Publications of the Ministry of the Interior 21/2012.
38 The operational response time of rescue services refers to the time that starts when the first unit receives the alarm and ends when the rescue team starts effective rescue operations. The rescue team consists of a commander, 3–7 persons and vehicles and equipment in accordance with the assignment.
39 379/2011.

rescue department. The emergency response instructions must be drawn up in such a manner that the emergency response centre can alert the nearest appropriate units for rescue operations regardless of which wellbeing services county they come from.

2.8 Other reports

2.8.1 The principle of operation of electric sauna heaters

The purpose of the sauna heaters is to heat up the sauna room and the sauna stones to reach the bathing temperature. In electric sauna heaters, there are electrical heating elements in the middle of sauna stones that start to heat up when the heater is switched on. The air around the heating elements warms up and begins to rise. The heat-induced airflow conveys heat from the heating elements to the sauna room. The phenomenon is called convection[40]. At the same time, heat begins to transfer from the heating elements to the sauna stones in contact with the heating elements by convention and to the stones not touching the heating elements by radiation. Correspondingly, as the stones heat up, heat is transferred from them to the stones next to them and to the heater structures. After the heater structures and stones have warmed up, the heat is also transferred from the heater to the sauna room by radiation. In addition, convection is formed in the side canal between the inner casing and outer shell and the outer surfaces of the heater. Normally, the temperature of the sauna stones is approximately 300 °C.

In many sauna heater, the sensor of the thermostat to keep the temperature of the sauna stable and the sensor of the overheat protector are connected to the heater, attached to the controls housing, for example. In heaters with a separate control unit, the sensors are often located in a separate sensor box attached to the sauna wall as instructed.

From the perspective of how the sauna heats up, the air flow through the stone space, i.e. free convection, plays an important role. According to the user instructions of the sauna heater, it will take about an hour for a properly insulated sauna to reach the required bathing temperature. The sauna stones normally reach the bathing temperature at the same time as the sauna room.

If the sauna stones have been piled too tightly in the heater, the air flow through the stone space will decrease. Less heat will be transferred from the heater to the sauna room with convection than intended. The cooling effect of air flow on the heating elements and stones will decrease and the heating elements will become hotter than normal with the same amount of electrical energy. Increasing amount of heat will start to be transferred from the heating elements by convection and radiation. The stones and the heater structures become hot, and the heater does not reach heat balance until at a higher temperature than before.

[40] Convection is the transfer of heat through gases or liquids with the flows generated by heat. It is caused by a temperature difference that generates differences in density. The hot, less dense substance rises upwards and the more dense, cooled substance sinks. The principle described here applies to ordinary sauna heaters based on free convection. In so-called ever-ready sauna heaters, free convection is enabled just before starting sauna bathing by opening the lid on top of the heater. Some ever-ready heaters also use a blower; in which case it is a question of forced convection.

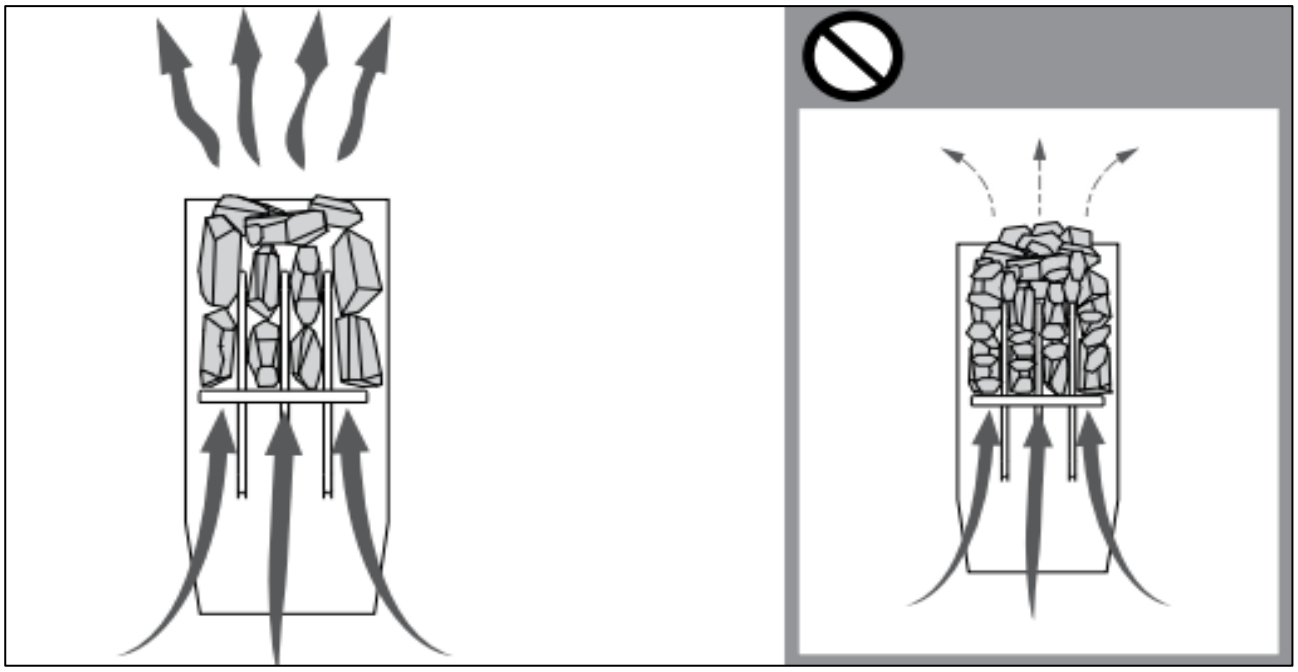

Figure 8. According to the user instructions, the stones must not be piled too tightly as this can prevent air from flowing through the heater. (Image: Harvia)

The manufacturer of the heater involved in the accident has tested the **significance of how the sauna stones are piled**[41] in a pillar-style heater using both new and old sauna stones. When the stones are piled loosely as instructed, more air can transfer to the sauna room and the sauna warms up faster. When new loosely piled stones were used, the maximum temperature of the heating elements was 580 °C, whereas when using old tightly piled stones the temperature was 680 °C. In the test sauna, with new loosely piled stones the temperature of the sauna was approximately 70 °C, while with old tightly piled stones it was about 60 °C.

In summary, based on the test results it was concluded that replacing the sauna stones and rearranging them improves the functioning of the heater and prevents premature breakage of the heating elements. A better heating capacity of the heater means reduced energy consumption.

The **conduction of heat** is effective in metals and also if metals, such as heating elements or heater structures, are in contact with each other. When hot stones are pressed tightly both against each other and against the heating elements and structures of the heater, they also conduct heat.[42]

The level of **thermal emittance** is determined by the fourth power of absolute temperature. For example, if the temperature of the heating elements is 680°C instead of 580°C, the thermal emittance of the heating elements is more than 1.5 times higher. Radiation transfers heat from heating elements to both the stones and heater structures. Under the bottom of the stone space, the radiation from the heating elements reaches the heater structures directly.

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41 https://www.harvia.com/fi/ideat-ja-trendit/vastuullisuus/vaihda-kiuaskivet-ja-vauhdita-saunan-lampenemista-saasta-energiaa-ja-aikaa/

42 Stones conduct heat less effectively than metal. The thermal conductivity of stones is influenced by the mineral composition of the stone and the orientation of its structure.

2.8.2 The cooling effect of throwing water on heated stones

When throwing water on the heated heater, the water heats up to the boiling point and vaporises. It requires approximately 2,600 kJ of energy, to warm up and vaporise one litre of water. With 6 kW heating elements, it takes more than 7 minutes to produce this amount of energy. If 1.5 dl of water is thrown on the heated heater every minute and all the water vaporises, all the heat produced by the heating elements during the minute is required to make the sauna steam (löyly).[43]

2.8.3 Heating elements of the sauna heater involved in the accident

The sauna heater involved in the accident had three electrical heating elements with a nominal output of 2 kW. According to the information received from the manufacturer, the power relative to the surface area of the heating elements is 3,35 W/cm^2, which is calculated to correspond to a surface temperature of 600 °C.[44] At this temperature, the heating elements are red hot. According to the manufacturer, the maximum allowed temperature of the heating elements is 850 °C. The distance of the heating element closest to the wall is approximately 95 mm.

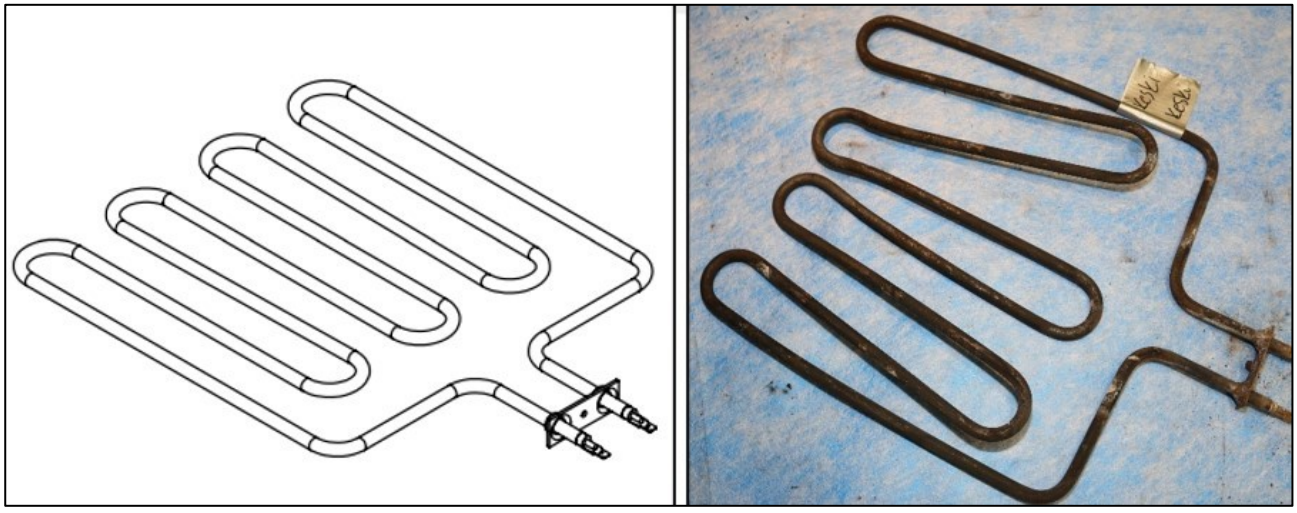

Figure 9. On the left, a technical drawing of the heating element of the heater and, on the right, the middle heating element of the heater involved in the accident (Image on the left: Harvia, photo on the right: Safety Investigation Authority, Finland)

According to the manufacturer, the heating element is 2,238 mm in length and its outer diameter is 8.5 mm. The casing, i.e. the outer surface, of the heating element is made of stainless steel[45] which has a melting temperature of approximately 1,400 °C. The inside of the heating element is magnesium oxide. The innermost part is the actual resistance wire. The heating elements of the heater were examined and found to be electrically intact. The steel shell of the heating elements had several hair cracks, some of which had leaked magnesium oxide on the surface of the heating elements. The heating elements had been bent to some

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43 The calculation has been made using a specific heat capacity of 4.19 kJ/kg°C and a specific steam heat of 2,260 kJ/kg. If the volume of the ladle is 4 dl, the water volume in the example corresponds to approximately one third of the volume of the ladle.

44 The surface temperature of the heating element has been calculated using the Stefan-Boltzmann law on the power radiated from a black body.

45 AISA 321.

extent. At least at one point, the heating element had been bent so that it touched the bottom of the stone space. No melting of the steel shell was detected.

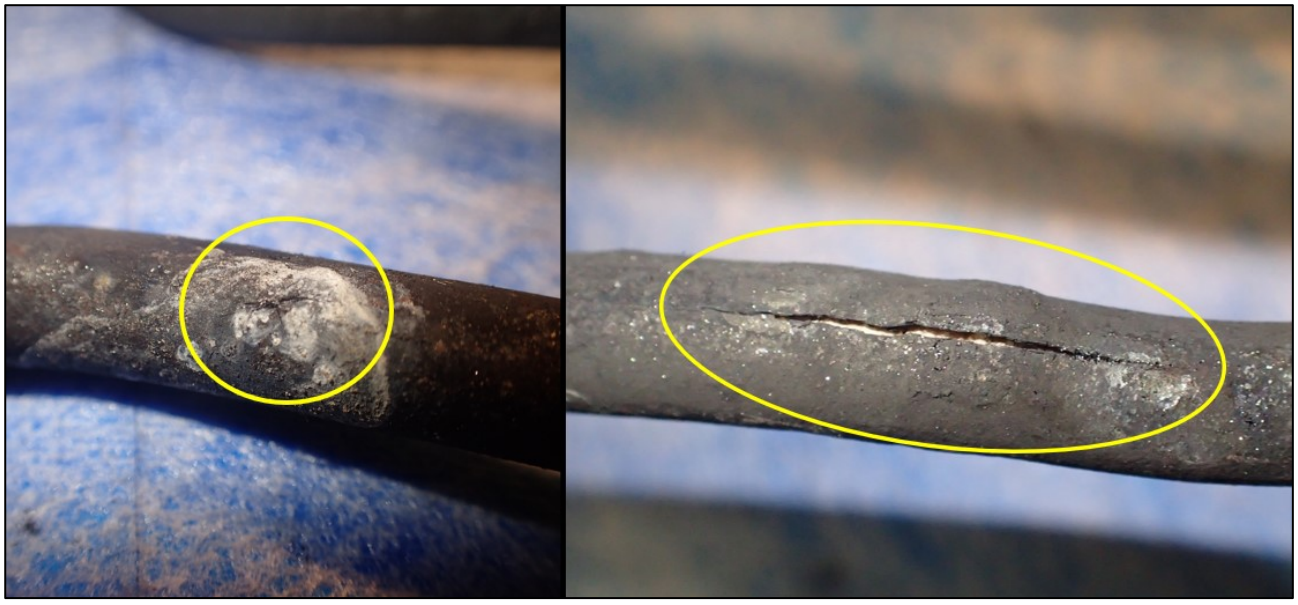

Figure 10. Hair cracks in the steel shells of the heating elements of the heater.

2.8.4 Deformation of the heater involved in the accident

There were bulges of different sizes throughout the heater's stone space casing. At the top of the heater, the mid-section of the heater frame had been bent outwards by approximately 5 mm and the mounting rack by 2 mm, correspondingly. The frame and the mounting rack had a visible heat pattern at this point.

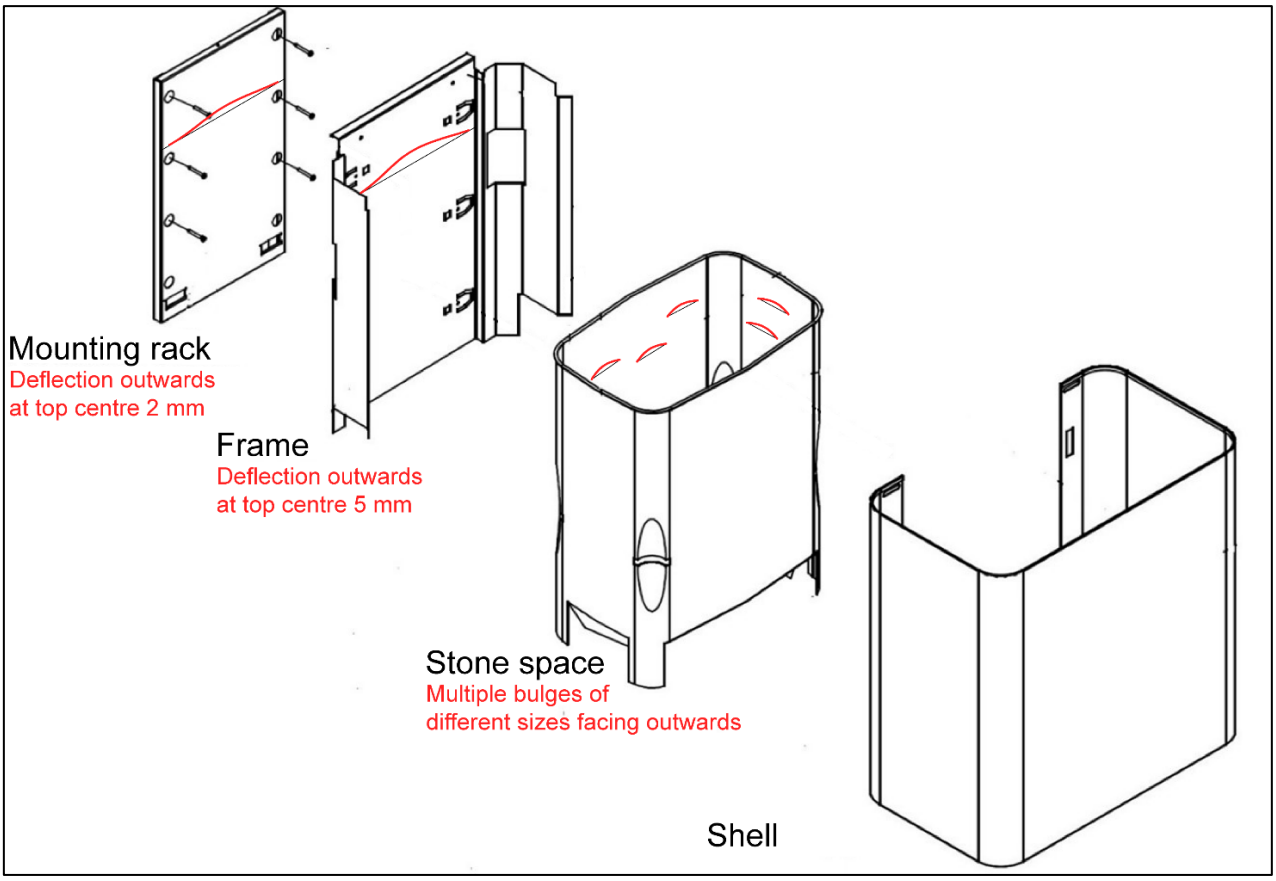

Figure 11. The structure of the heater and deformations observed in the investigation. (Photo: Harvia, edited by Safety Investigation Authority, Finland)

Figure 12. There were bulges of different sizes throughout the heater's stone space casing. The heating elements were not in place when the photos were taken.

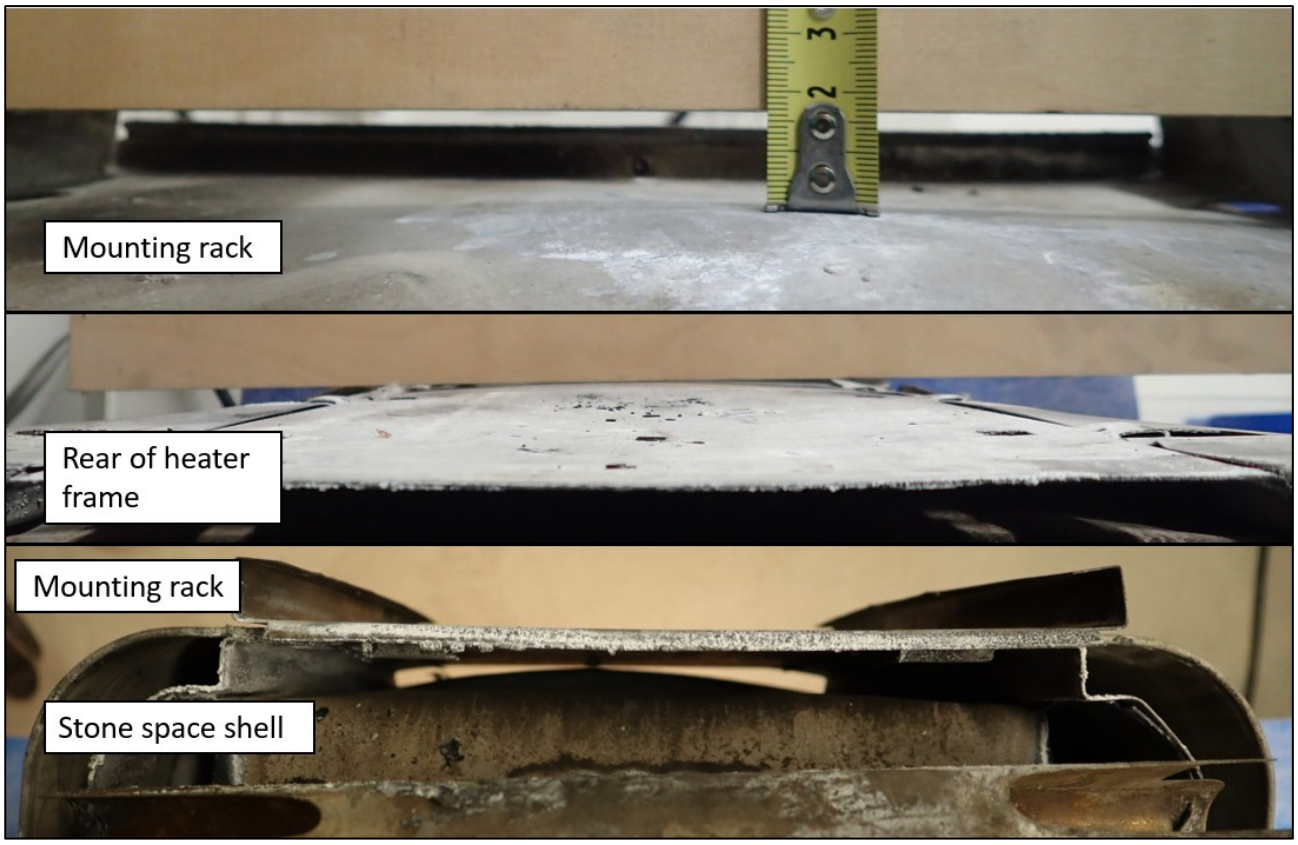

Figure 13. The photo on top shows the mounting rack with a sheet of plywood placed on top of it to measure the bend. The frame of the rack is bent from the top of the heater towards the panel wall by a few millimetres. The photo in the middle shows the rear part of the heater frame, where a bend of approximately 5 mm can be seen at the corresponding point. The rear of the frame had been in contact with the mounting rack plate at the point of the bend. At the bottom, the rear part of the heater photographed from bottom up. In the picture, the mounting rack is in contact with the heater, and the curved shape of the stone space casing can be seen well. (Photo: Safety Investigation Authority, Finland)

The significance of the structural changes in the heater was studied at SGS Fimko Oy. The frame of the heater involved in the accident was equipped with intact heating elements, thermostat and timer taken from the reference heater. The heater was tested in accordance with the test arrangements complying with the standard for sauna heating appliances[46] to the extent possible. The stone space of the heater was filled with used sauna stones in good condition piled in a normal manner. Temperatures were measured from behind the heater, from the wall above the heater and between the heater and the wall. One measuring point was on the wall at the spot where the heater had a bulge. All measured temperatures remained within the limits defined by the standard and no temperatures exceeding the permitted level were observed on the wall surface behind the heater.

[46] International Standard 60335-2-53 Safety of household and similar electrical appliances – Part 2: Particular requirements for sauna heating appliances

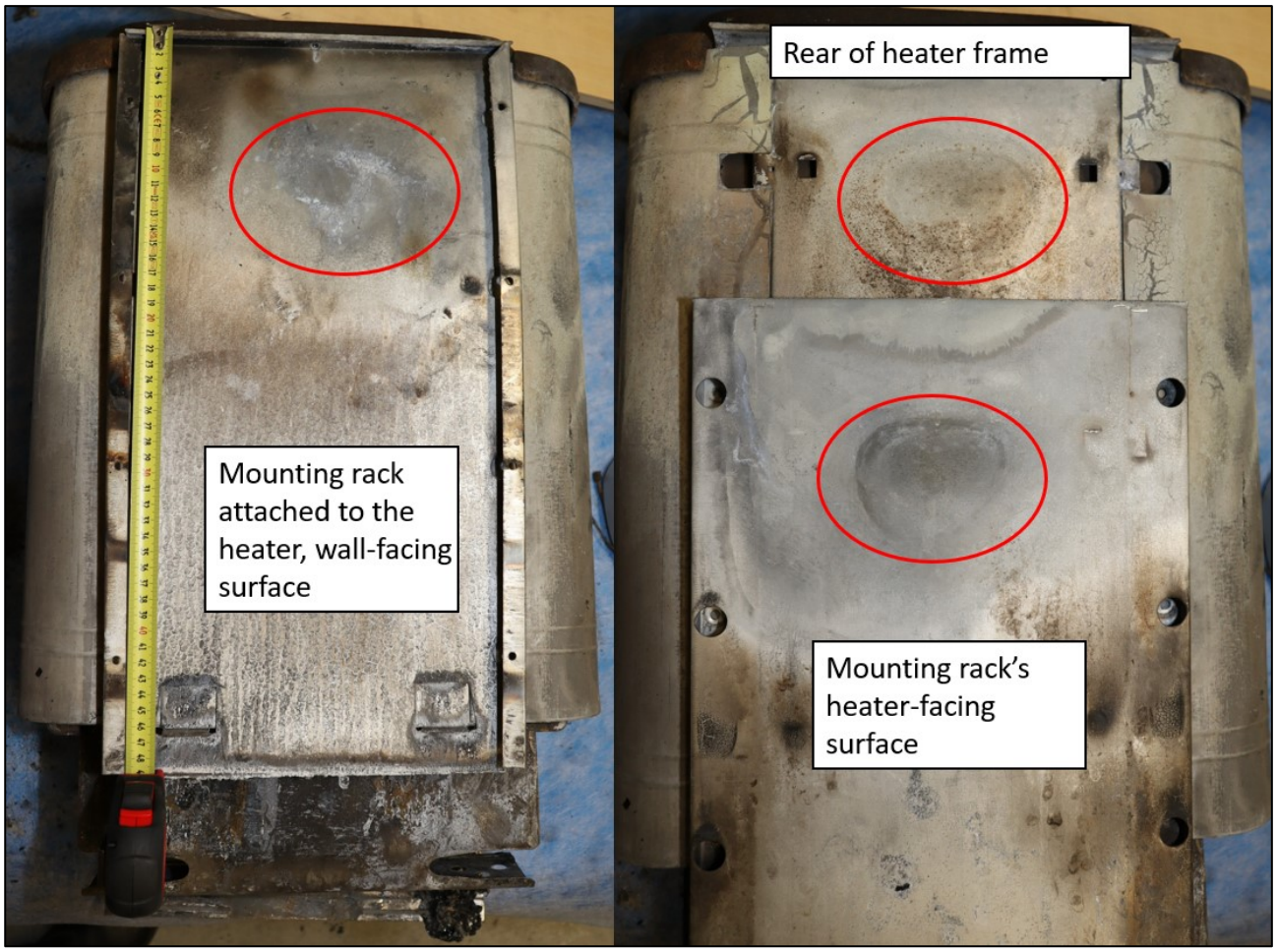

Figure 14. Heat patterns were visible in the middle of the top part of the heater and the mounting rack. On the left, the surface of the mounting rack that faced the wall, and, on the right, the surface of the mounting rack that faced the heater at the bottom and the back wall of the heater frame on top. (Photo: Safety Investigation Authority, Finland)

To determine the maximum temperature reached by the mounting rack, metallurgical studies were conducted on the heater involved in the accident at the materials and mechanical engineering research unit of the University of Oulu.

The maximum temperature reached by the mounting rack was estimated by comparing metallographic cross-section samples cut from the rack with reference samples annealed at 200–700 °C at 50 °C intervals. The comparison was made using three different methods: examinations of the microstructure of the coating, the zinc and aluminium contents of the coating and the thickness of the coating. The conclusion drawn from the studies was that the highest temperature in the mounting rack of the heater involved in the accident had probably been between 450 and 550 °C.

Based on the examination of the microstructure of cross-section samples, part of the coating had peeled off. In addition, a zone appearing grey in the microstructure images had also formed in the interface between steel and the coating. A corresponding grey zone could be detected in reference samples annealed at increasing temperatures at the temperatures of 500 °C and above. Based on the results of the comparison of zinc and aluminium concentrations, the temperature did not have much effect on the zinc concentration of the reference samples, but their aluminium content started to decrease as the temperature rose

above 450 °C. Based on the aluminium concentrations measured in the heater involved in the accident, the temperature of the mounting rack would have been between 450 and 550 °C. Based on the thickness measurements of the coating, it was found that in the reference samples the coating started to get thinner when the temperature exceeded 500 °C. Starting at 550 °C, the coating was significantly thinner than at lower temperatures. In the samples taken from the heater involved in the accident, the coating thickness had not yet started to get thinner. Based on the thickness of the coatings measured from the heater involved in the accident, the temperature of the mounting rack would not have exceeded 550 °C.

2.8.5 Darkening of the panel wall of another sauna

During the investigation, it was found out that the panel wall above the sauna heater had darkened in another apartment in the building where the accident happened. No deformations or other deficiencies were observed in this sauna heater.

Figure 15. The sauna heater in another apartment in the building where the accident happened. The panel wall above the heater has darkened significantly. Some of the topmost stones on the heater were quite large. (Photo: Safety Investigation Authority, Finland)

SGS Fimko Oy performed another test on the heater involved in the accident following the standard test procedure in such a manner that a darkened panel wall was used as the background wall.[47] The stone space of the heater was filled with used sauna stones in good condition. According to the results of the test, the temperatures measured on the wall surface remained within the limits defined by the standard at all measuring points.

In addition, a test was carried out in which the same sauna heater was attached to a wall lined with insulating wool. The purpose of the test was to measure surface temperatures under conditions where the wall structure absorbs as little heat as possible. The highest wall

[47] A renovation was planned for the sauna, which made it possible to remove the panel wall of the sauna for research use.

temperature measured during the test was slightly above 140 °C at the spot above the collar of the heater along its centre line. The shapes displayed in the image acquired using an infrared camera correspond well with the darkened area on the wall.

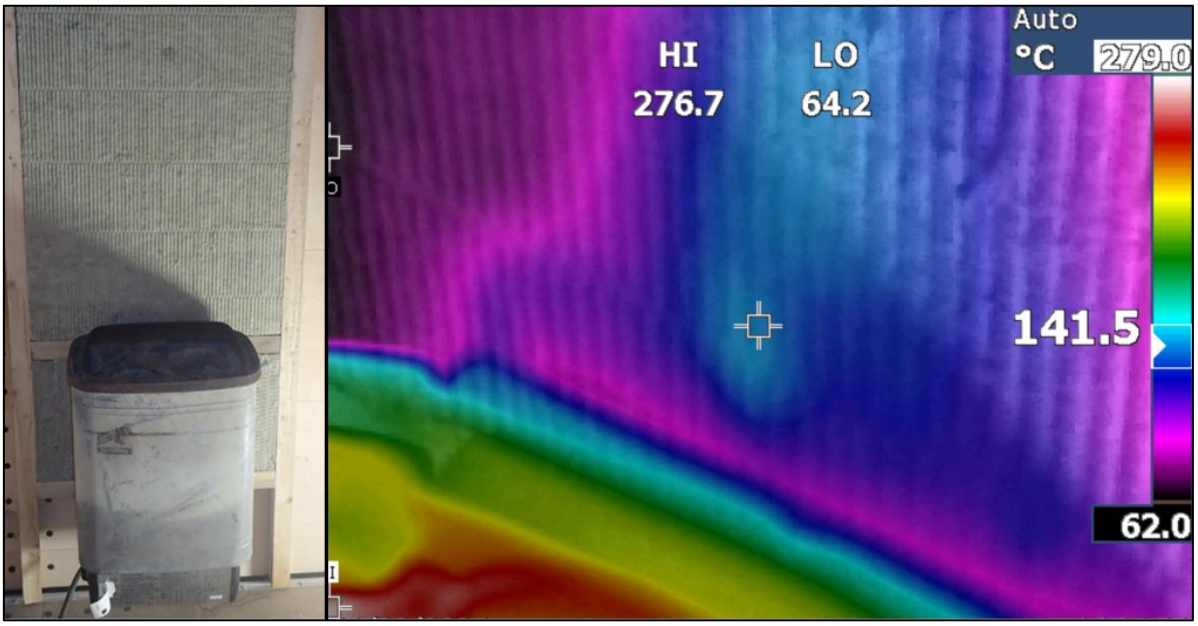

Figure 16. On the left, the heater involved in the accident is attached to a wall lined with insulating wool. On the right, an infrared camera image in which, in the spot indicated by the cursor in the middle, the temperature was slightly above 140 °C. In the lower left corner of the image, the highest temperature above the sauna stones was 276 °C. (Image: Safety Investigation Authority Finland,)

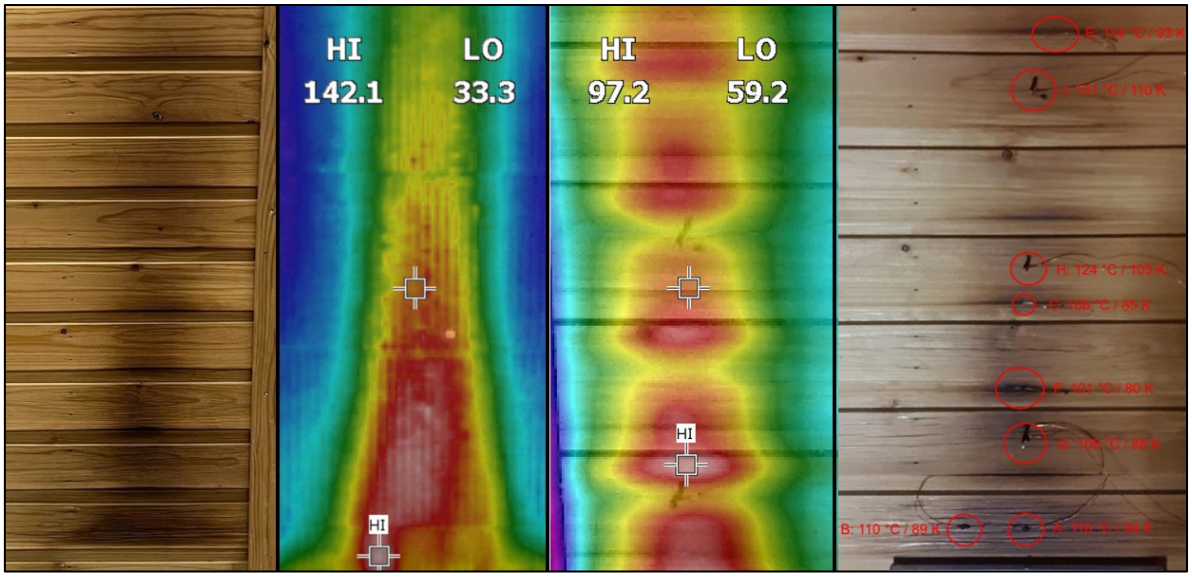

Figure 17. On the left, the darkened wall of another apartment. The second image shows an infrared image of the wall lined with insulating wool taken at the corresponding spot above the heater. At the spot indicated by the cursor in the middle, the temperature was slightly above 140°C. The warm area corresponds well with the darkened wall. The third image shows an infrared image of the panel wall above the heater. The temperature is highest at the seam of the panel. On the right, temperatures observed at different measuring points in the test. The highest temperature measured was 131 °C. (Figure: Safety Investigation Authority, Finland)

In the tests carried out at SGS Fimko, the stone space of the heater involved in the accident was filled with sauna stones in good condition piled in a normal manner. In the tests, the temperatures of the walls did not rise above the temperatures permitted by the standard. The structural changes in the heater and the bends at the rear of the heater alone are not sufficient to explain why the fire started.

2.8.6 Sauna stones and heater structure

The amount of sauna stones in the heater involved in the accident was normal. The stones were tightly placed in the stone space of the heater and some of them were wedged between the inner casing and the heating elements. Because the heating elements are not supported separately, the stones pressed on them so that they were bent. At least at one point, because of the stones, the heating element had been pressed tightly against the bottom of the stone space. Some of the stones showed discolouration.

Figure 18. On the left, a photo taken during the site investigation, in which about two layers of stones had already been removed from the heater. The stones were in a tight contact both with each other and with the electrical heating elements and the casing of the stone space. The charred pieces of wood had fallen on top of the heater during the fire. On the right, the photo taken after the stones were removed shows one tightly wedged stone that had pressed the heating element against the heater's metal structure. (Photo on the left: the police; Photo on the right: Safety Investigation Authority, Finland)

The **structure of the heater involved in the accident as a flow-through heater** was examined from the perspective of flow dynamics theory. The controls housing is located under the stone space so that it accounts for clearly more than half of the horizontal cross-sectional area of the lower part of the heater. There is space left for free flow of air around the connection box so that the width of the opening at the bottom of the outer shell is approximately 1–4 cm.

The direct route of the airflow runs from bottom up in the spaces between the inner casing and outer shell of the heater, i.e. the side canals. The slanted structures of the lower part of the inner casing under the stone space direct air to the side canals.[48] The air into the stone space mainly comes from the approximately 3 cm high openings above the controls housing, i.e. the connection box. To enter these openings, the air flow must turn rectangularly, away from the direction of free flow through the side canal. If stones disintegrate, the slanted structure of the

[48] The joint cross-sectional area of the side canals in the bottom part of the heater is approximately 190 cm^2. The smooth-walled side canals have low flow resistance.

lower part of the inner casing guides the disintegrated stones over the connection box, increasing the flow resistance along the route leading to the stone space. Some air also enters the stone space through the small openings in the lower corners of the heater.[49]

The side canal at the rear of the heater is slightly narrower than the side canals on the other sides. There is also a 2 cm wide flow opening behind the heater, i.e. between the mounting rack and the wall.[50]

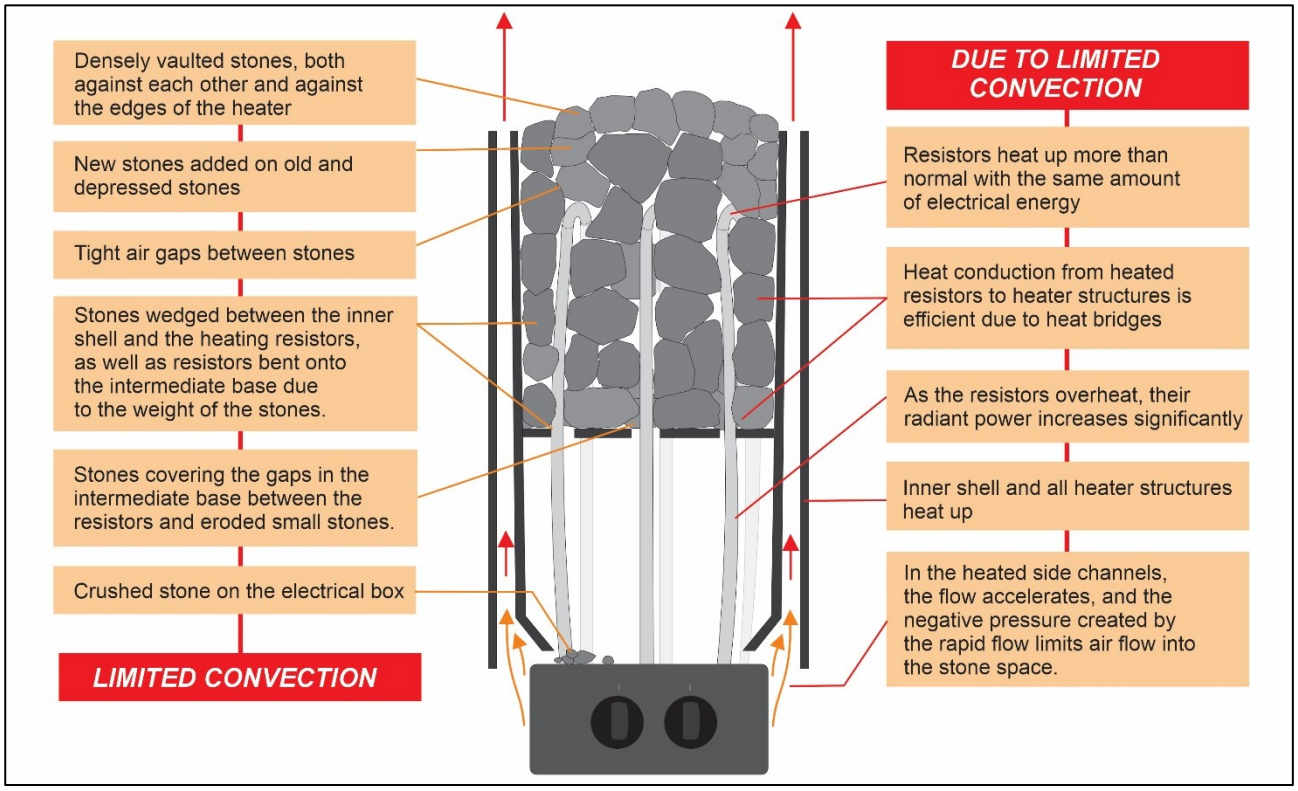

Figure 19. Examples of key factors limiting convection and consequences of limited convection. (Photo: Safety Investigation Authority, Finland)

For the sauna heater to function as a flow-through heater, the air must flow through the stone space by means of free convection. However, convection may be limited if the stones are pressed tightly against one another and against the sides of the heater, or if new stones are added on top of the old, compacted ones. In such a case, narrow air gaps between the stones significantly choke the flow. The stones may also be wrongly placed to begin with, for example, so that stones block the flow openings between the heating elements.

When the convection through the stone space does not cool the heating elements sufficiently, they heat up more than normal with the same amount of electrical energy. Therefore, the stones and heater structures start storing heat. As the structures heat up, the flow rate in the side canals also increases, i.e. the chimney effect accelerates. This means that the flow conditions under the heater change: the vacuum created by the rapid flow of air in the side

[49] The combined cross-sectional area of the flow openings leading to the stone space is approximately 175 cm^2.

[50] Between the mounting rack and the wall, the roughness of the wall panel surface increases the flow resistance in the opening. In addition, the top edge of the mounting rack, which is approximately 1 cm wide, turns directly over the flow opening.

canals starts to limit the amount of air turning into the stone space. This further reduces the cooling of the heating elements and stones through free convection.[51]

From an overheated heater, heat is transferred to the sauna room by radiation, especially from the hot stones on top, and through convection from the side canals and the outer surfaces on the sides of the heater. However, heat transfer through radiation is only effective at high temperatures, and convection of the side canals and outer surfaces is not sufficient to directly replace convection through the stone space. For this reason, under the accident conditions, the heater did not reach heat balance – the situation in which the electrical energy supplied to the heater corresponds to the thermal energy transferred from the heater – until at a temperature significantly higher than normal.

2.8.7 Self-ignition of the panel wall

Self-ignition refers to the ignition of a material without an external source of ignition, such as a spark or a flame. Self-ignition is a complex process affected by factors such as heating capacity, mode of heating, the characteristics and geometry of the material, flow conditions and oxygen content.

A wall panel, which has been in use for several years, contains plenty of holes and gaps created by both the planning process and the cracks caused by drying and ageing. In such a case, the interaction between surfaces, i.e. thermal coupling, promotes smouldering in the internal gaps of wood. Surfaces separated by a narrow gap smoulder and are set on fire more easily than an even surface.

At a temperature of 450–550 °C reached by the mounting rack, the radiative heat flow density to the wall is calculated to be 12–20 kW/m^2. The critical limit for smouldering ignition is generally considered to be around 250 °C. This is related to carbon oxidation reactions that start to occur to a significant extent only at temperatures higher than this. It has been found that smouldering fire can lead to flaming fire with a heat flow density of less than 10 kW/m^2, and the theoretical lower heat flow density limit for the self-ignition of wood can be considered to be approximately 5 kW/m^2. In the latter case, the ignition time would already be several hours. This heat flow density can be reached either by convection when the ambient temperature is several hundred degrees or by radiation when the radiant surface temperature is approximately 270 °C.

In other words, at 450–550 °C, the temperature of the mounting rack is clearly in the area where the wood can spontaneously ignite. However, it is difficult to determine the time for self-ignition to happen because the process is sensitive to all boundary conditions and changes in different values. In addition, the flammability zone boundary is steep, i.e. either nothing happens, or ignition can be very rapid, which in practice means a sudden thermal runaway. With exposure as hot as in this case, this is probably not a very long process. The time required for ignition can be estimated to be of the same magnitude as the time required for the wood panel to be charred through. At the mounting rack temperature of 450°C, the panel would be charred through in just under 1½ hours and at 550°C in just over half an hour.

The exceptional darkening of the surface of the wall panel of another apartment mentioned earlier may be the result of the heater warming up to a higher temperature than normal. The investigation revealed no cases in which the panel wall above the heater would have ignited.

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[51] In theory, the vacuum caused by airflow in the side canals could draw air from the lower part of the stone space. The stone space would then draw hot replacement air from the top of the stones, which would lead to the heater heating up rapidly and strongly.

2.8.8 Observations on sauna safety in the Vuosaari fire

In 2016, there was a fire in an apartment in Vuosaari, Helsinki, which was investigated by the Accident Investigation Authority, Finland.[52] The fire led to the death of everyone in the apartment, an immigrant mother and her three children. The fire started from an electric sauna heater that had been activated purposefully or accidentally. No fault was found with the heater in the technical investigation. The heated up heater set fire to the ignitable material in the immediate vicinity of the heater.

The investigation revealed that the maintenance company had not been instructed to inspect the condition of the apartments' saunas and sauna heaters when the tenant changes. Furthermore, there were no questions on their condition in the initial checklist form intended to be filled in by the new tenant and returned to the housing company.

The investigation drew attention to the logic of the control switches of an electric sauna heater and their location at the very bottom part of the heater. They do not take the point of view of an unaccustomed user properly into account. The switches are easily accessible to children and have no child lock mechanism. Furthermore, the sauna heater does not have any indicator to signal that the heater or its timer has been activated, such as a light.

The investigation recommended that the largest manufacturers of electric sauna heaters develop the use of the sauna heaters in a way that makes the operation of the control switches understandable, clearly indicates to the user that the timer or sauna heater has been activated, improves the operating ergonomics and provides sufficient child safety features. These human error prevention features are also required in entry-level sauna heaters.

The recommendation issued in the investigation has been partially implemented. In 2023, one of the requirements added to the standard SFS-EN 60335-2-53 on sauna heating appliances and infrared cabins stated that the heater must feature an indicator showing when it has been activated. If it is possible to set the heater to a remote operation mode, or it has a delayed switch-on action, it shall indicate that this function is activated and that two separate actions are required to activate the function.

2.8.9 Assignments related to electric saunas in rescue services statistics

The investigation examined the rescue services assignments caused by electric saunas in the Pronto system[53]. Between 2018 and 2022, the average number of such assignments was 85 per year. In slightly over 2/3 of these, the assignment was estimated[54] to have been caused by a technical fault and in less than 1/3 by human activities.

The most common technical faults were defects in the heating elements, which accounted for about 40% of the technical faults. According to Pronto records, the heating elements could, for example, burst into flames, crackle, get scorched or fly sparks. Approximately one in five technical faults were unspecified defects in the heater and about one in eight defects in the control switches or thermostat. Other technical faults included defects in electrical connections, other electrical faults and short circuits, and overheating of heaters.

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52 Safety Investigation Authority (2017) *Fire that resulted in the deaths of four people in an apartment in Vuosaari, Helsinki on 9 December 2016*, Investigation report Y2016-05.

53 Pronto is a resource and accident statistics system for rescue services used for monitoring and developing rescue services and investigating accidents.

54 The information recorded in Pronto is largely based on the entries made by the officer in charge of rescue operations quite soon after the end of the assignment. For example, in case of fire, the officer in charge of rescue operations must assess the cause of fire and the human contribution to the fire. These estimates are usually not specified later, as a fire investigation is carried out only in part of the fires.

In assignments caused by human activity, the most common reason was items placed on top of the stones or in the vicinity of the heater, which were mentioned as the reason in more than 70% of these assignments. Among the things that had ended up on top of the heaters were ladles or dishes. The most typical things catching fire in the vicinity of the heater were drying clothes. The assignments indirectly caused by renovation or other work accounted for about one in seven of the assignments.

A five-year review revealed 21 assignments where the wall or benches of the sauna had ignited or were at the risk of ignition. In these assignments, the officer in charge of rescue operations has assessed that the fire was caused by such factors as insufficient safety distance, overheating of the heater or long-term heat effect. The records were not accurate enough to establish the exact cause of fire. The investigation sought to examine the cases in more detail by contacting the rescue departments. The examinations did not provide any certainty as to whether there had been similar cases among the assignments to the case under investigation.

During the period under review, there had been two **fatal fires** that had started from an electric sauna. In the past ten years, there have been two fires that started from an electric sauna that led to the deaths of more than one person. These were the 2016 fire in Vuosaari and the fire under investigation.

2.8.10 Examples of fires caused by electric sauna heaters

The investigation team asked rescue departments for information on certain assignments related to electric saunas found in the Pronto system in which the panel wall adjacent to the sauna heaters had been damaged.

In 2021, there was a fire in **Päijät-Häme**, where sauna goers detected some smoke rising from between the heater and the panel wall at the end of a fairly long session of sauna bathing. They carried out the first response firefighting measures successfully, and the rescue department secured the situation. The resident of the apartment was heard in connection with this investigation. As far as he could recall, the heater had been approximately three years old at the time of the incident. The sauna stones had possibly been replaced once, and some stones had been added at some point. According to the resident, no signs of darkening had been observed on the wall above the heater.

When the site of fire was cleared, the panel behind the upper part of the heater was found to be significantly charred. The most badly charred section was at the middle of the heater.

Figure 20. In the Päijät-Häme fire, the wall panel behind the sauna heater was significantly charred. (Photo: Päijät-Häme Rescue Department)

In 2022, there was a fire in **Kanta-Häme**, which started from the ignition of the panel wall next to the electric heater. The heater had been turned on for four hours. One person took a sauna when it had been on for half an hour. After this the heater stayed on for about three hours without any water having been thrown on the hot stones before the wall ignited. The distance to the heater from the wall was 145 mm, which is 45% more than the safety distance of 100 mm according to the installation instructions. The investigation revealed that the heater was too low-powered for the sauna in question and that the separate wall-mounted temperature sensor of the thermostat had been installed in the wrong place. Because of these factors, the heating elements of the heater stayed on for longer than intended. Sauna goers felt that the heat in the sauna was mild, so the temperature setting of the sauna had also been increased. The stones had not been rearranged for 4.5 years.

The overheat protector of the heater in connection with the temperature sensor had gone off, but this had not prevented the fire from breaking out.

Figure 21. When stones were removed from the heater involved in the fire in Kanta-Häme, it was found out that they were compacted to a significant degree. Heating elements of the heater were bent so that some of them were touching one another. The stones in the middle of the heater were discoloured. (Photo: Kanta-Häme Rescue Department)

Due to the stones being so compactly placed, convection did not transport heat from the heating elements to the sauna room as intended. Instead, the heat accumulated in the stones and heater structures. The heater became so hot that its radiant heat was sufficient to ignite the nearest part of the panel wall.

In 2024, there was a fire in **North Savo**, in which the panel wall of the sauna ignited above the heater attached to the wall. The heater had been installed approximately 12 years earlier. Before the fire, the heater had been on for about an hour. The heater had a separate control centre, and a temperature sensor attached to the wall. The heater was of a different model than the one involved in the fire under investigation, but there were many similarities in the frame structures of the heaters. For example, the mounting rack is similar to the one currently

under investigation. Similarly, the structure of the lower part of the heater with slanted plates in the inner casing is the same.

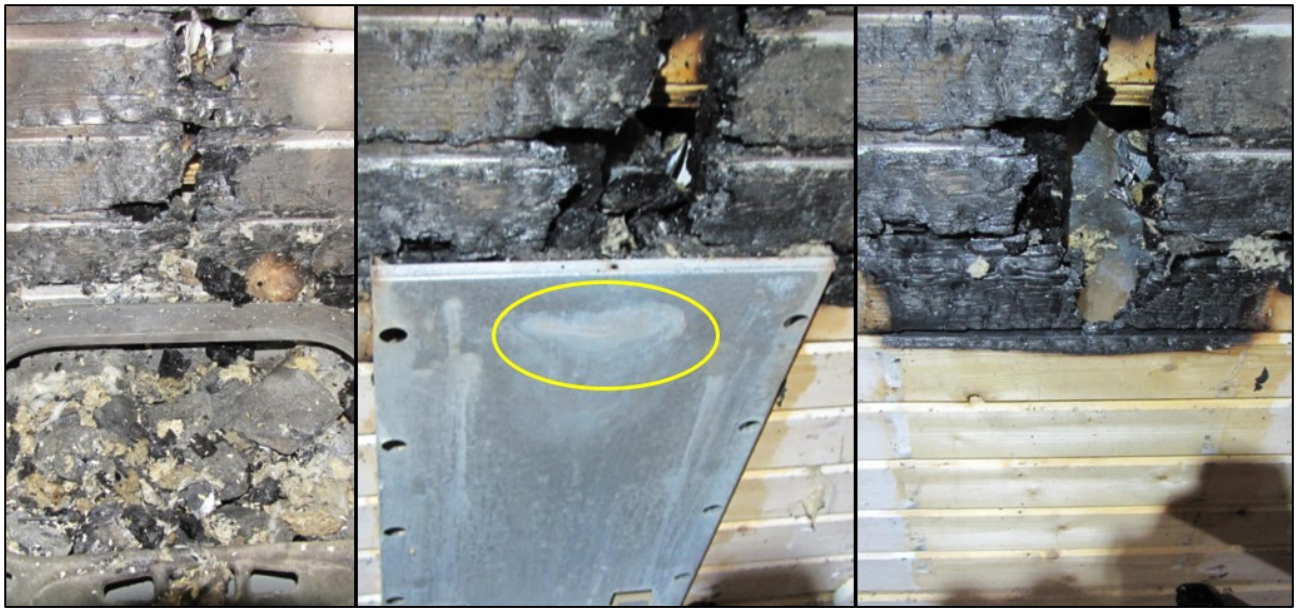

Figure 22. In the fire in North Savo, the fire started at the same point as in the fire under investigation. In the photo on the left, the heater is in place. In the photo in the middle, the heater has been removed and the pattern left by heat is visible on the mounting rack at the same location as in the fire under investigation. Judging by the image on the right, it seems that the panel wall ignited at exactly the same spot where the heat pattern can be seen. (Photo: North Savo Rescue Department)

Based on the information received, it appears that the temperature sensor had not been installed in the location specified in the instructions for installation and use. As a result, the heater's heating elements may have been on for longer than intended, so the heater had operated at a hotter temperature than designed.

2.8.11 The safety of immigrants' everyday life and housing

During the investigation, **African concepts of safety** were examined with three different experts. The matter was also discussed with the father's relatives living in Finland. Africa is a very large continent, which means that there is no single African culture. Instead, the culture of the continent consists of a wide variety of cultures. The following interpretations are therefore generalisations, but on the other hand, efforts have been made to target the observations so that they would be as relevant as possible with a view to the accident under investigation.

In Africa, the frequency of accidents, understanding of hazards and attitudes towards risks are different from those in Western countries. The safety of everyday living and housing is different in African countries than in Europe. In Africa, due to the climate, houses are loosely built or are partly open. Food may also be prepared on open fire indoors, at least in rural areas.

Smoke alarms are not usually used in African houses, so their sound and operating model related to the sound may not be immediately familiar to those who have moved from Africa to Finland.

When decorating their apartments, African people prefer large furniture. However, in cramped rooms, it may be difficult to place large couches, for example. Large pieces of furniture may end up in front of passageways, such as the door to a balcony or terrace. This means that the other escape route from the apartment may not be available at all in case of an emergency. Some may even consider not using the separate exterior door as a positive thing, especially in a apartment at the ground level: children stay safely indoors, and the mother does not need to get dressed for going out.

According to studies on naturalistic decision-making[55], people's decisions in a rapidly progressing emergency or hazardous situation are often not based on rational consideration or a detailed review of different options. Usually, people intuitively choose a previously used or otherwise well-integrated operating model that the new observations they make of their surroundings and the messages they receive most closely resemble and support. After that, they instantly run through the operating model they have intuitively selected in their own mind. If such an analysis reveals that the model is not suitable for the situation, only then they will specify or modify it by searching for and interpreting new information. For those who have moved to Finland as adults, the intuitive model may be the one they have used as children or young people when living in a different culture and that they have internalised at the time. In the accident under investigation, in the mother's mind the observations and messages may have evoked an idea that smoke does not represent an immediate danger. Unfortunately, other factors related to the situation did not leave time for the mother to a specify or reinterpret her impression of the situation.

Questions of **immigration and integration** were examined quite extensively in the investigation report on the fire in Vuosaari, Helsinki in 2016[56]. The mother of the family, who died in the fire, had come to Finland as the spouse of a Finnish citizen, i.e. due to family ties, and she was also a stay-at-home mother in Finland. She started integration training about three years after arriving in the country, after the youngest child had turned two. At the time, the Accident Investigation Authority, Finland noted that the bigger the difference between the Finnish culture and the immigrant's own culture, the weaker safety skills the immigrant has. Immigrants encounter new and different risks in Finland. The significance of such risks may become emphasised in individual activities, such as in scenarios with stay-at-home mothers. Inclusion in society and the development of safety awareness require contact with other people as well as practical support and guidance.

55 Klein, G. (2008) *Naturalistic Decision Making*. Human Factors, 50(3), 456-460.

56 Safety Investigation Authority (2017) *Fire that resulted in the deaths of four people in an apartment in Vuosaari, Helsinki on 9 December 2016*, Investigation Report Y2016-05.

3 ANALYSIS

The Accimap method[57], developed further by the Accident Investigation Authority, has been used to analyse the incident. The breakdown of the analysis text is based on the Accimap diagram drawn up in the investigation. The accident is described as a chain of events in the lower part of the Accimap diagram. Factors found in the background of the chain of events are examined in the diagram at different levels of analysis.

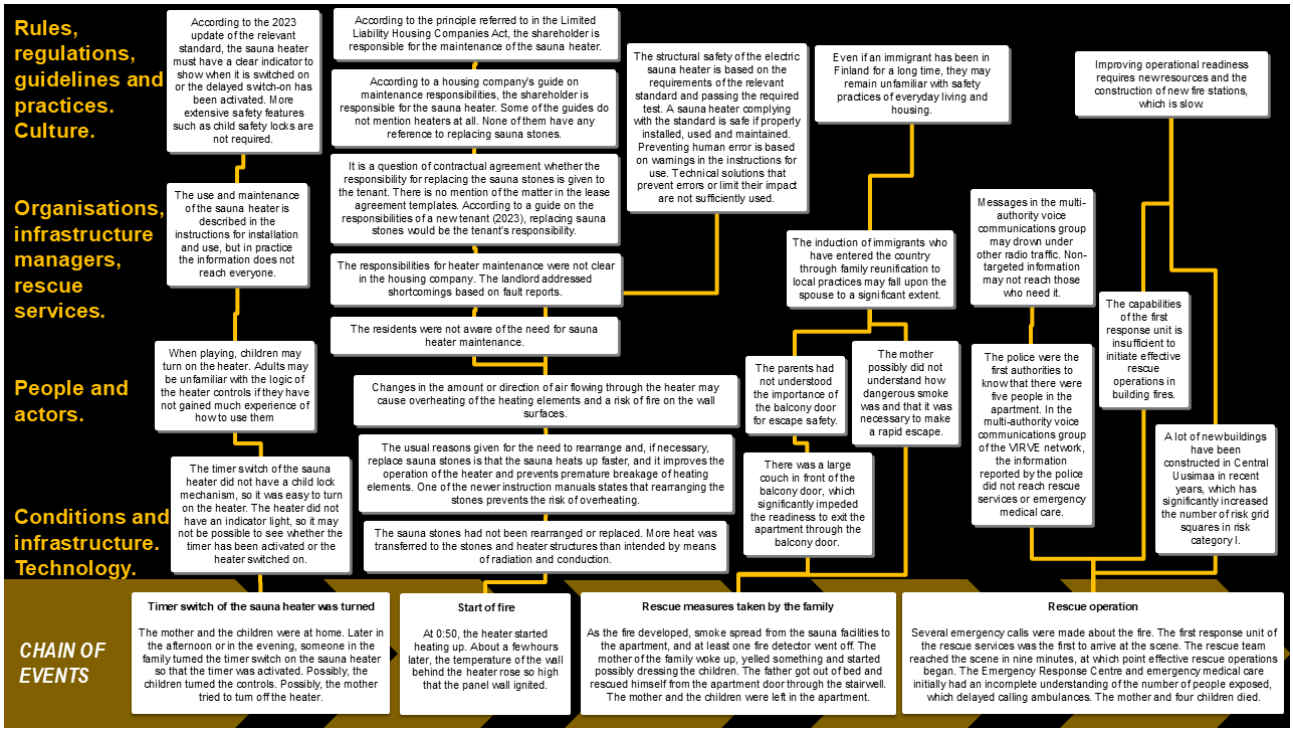

Figure 23. ACCIMAP analysis diagram for the Y2023-02 investigation. (Photo: Safety Investigation Authority, Finland)

3.1 Analysis of the incident

3.1.1 Timer switch of the sauna heater was turned

The family's mother and children were at home. During the evening, at 16:50 at the earliest, someone in the family turned the timer switch of the sauna heater so that the timer was activated. It is possible that, while playing, one of the children turned the timer switch located on the bottom part of the heater. It is possible that the mother tried to turn off the heater after the children without succeeding in this. The mother had no experience of using the heater.

The heater timer switch did not have a child safety lock or any other mechanism preventing it from being turned unintentionally, so it was easy to switch on the heater. The heater did not have any indicator light to tell whether the timer had been set or the heater switched on, so their activation may go unnoticed. When playing, children may switch on the heater. Adults may be unfamiliar with the logic of how to operate the heater controls if they have not gained experience of their use. The instructions for use and installation of the heater describe how to use the heater, but, in practice, this information does not reach everyone.

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57 Rasmussen, J. & Svedung, I. (2000) *Proactive Risk Management in a Dynamic Society*. Karlstad, Sweden: Swedish Rescue Services Agency.

The standard concerning sauna heater was updated in 2023. The heaters shall have a clear indicator showing when it is switched on or delayed switch-on is activated.

3.1.2 Start of the fire

The sauna heater switched on at about 0:50. The heater was on for longer than normal and without the cooling effect of water being thrown on the hot heater. A couple of hours later, the temperature of the wood panel behind the heater rose so high that the wall ignited.

The stones in the heater had probably not been rearranged or replaced for years. Resulting from use, they were wedged against structures, pressed together and disintegrated so that the air circulation through the stone space was obstructed.

Due to limited convection, less heat from the heating elements was transferred to the sauna room through the stone space than intended, and the heating elements heated up more than normal. More heat was transferred by radiation and convection to the stones and heater structures than intended, which resulted in the heater heating up significantly. The temperature of the mounting rack, i.e. the third and outer metal surface when counted from the heating elements, was 450–550 °C. The high temperatures had caused some deformations in the heater, which had slightly reduced the distance between the mid-upper part of the mounting rack and the panel wall. The wall ignited at this point.

The usual reasons given for the need to rearrange and, if necessary, replace sauna stones is that the sauna heats up faster, and it improves the operation of the heater, prevents premature breakage of heating elements and reduces energy consumption. One of the newer instruction manuals states that rearranging the stones prevents the risk of overheating.

According to the manufacturer's instructions for installation and use, changes in the amount or direction of air flowing through the heater may cause overheating of the heating elements and a fire hazard to the wall surfaces.

The tenants were not aware of the need to maintain the sauna heater. The sauna user may not detect the need for maintenance because they can use the sauna without any problems. Usually, the duration of sauna bathing may be short and involve throwing water on the heated stones. In such a case, the heater structures do not heat up excessively.

In its resident instructions on its website, the VAV Group had assigned the responsibility of replacing sauna stones to its tenants, but in the responsibility distribution table between VAV Palvelukodit Oy and VAKE the matter had not been agreed on. The lessor VAV and VAKE react to shortcomings in sauna heaters based on fault reports and inspected the heater superficially when the resident changed.

Assigning the responsibility for replacing sauna stones to the tenant is a contractual issue. There is no mention of the matter in the tenancy agreement templates. According to a new guide on the tenant's maintenance responsibilities published in 2023, replacing the sauna stones would be the responsibility of the tenant. According to a guide on the responsibilities of a housing company, the responsibility for the heater belongs to the shareholder. Some guides on housing companies' responsibilities do not mention sauna heaters. The replacement of sauna stones is not mentioned in any of the guides on housing companies' responsibilities. According to the principle referred to in the Limited Liability Housing Companies Act, the shareholder is responsible for the maintenance of the sauna heater.

Regular rearranging of the sauna stones ensures sufficient air flow through the heater and reduces the risk of overheating. The significance of rearranging the stones for fire safety has not been sufficiently recognised. The matter has been discussed at a general level as the need

to maintain the sauna heater. Instead, it would have been necessary to refer to the need to rearrange the stones in more concrete terms. There is no working practice on how to rearrange the stones.

The structural solutions and protective distances used in the heater involved in the accident complied with the requirements of the relevant standards. Still, they were not sufficient to prevent the heater from overheating and the ignition of the wall surface. The overheat protector of the heater did not go off or prevent the accident.

The minimum safety distances specified by the heater manufacturer are usually used in the design and construction of electric saunas. In this case, safety is based on the assumption that the heater works correctly and as designed in all situations. The minimum distances between electric heaters and combustible surfaces are determined in accordance with standard tests. A heater manufactured according to the standard is safe if it is installed, used and maintained correctly. Human activities play a major role in ensuring safety.

Typically, there are no structural solutions in sauna heaters that would prevent air circulation from being obstructed due to the tight piling of stones or the compaction and disintegration of stones. The possibility of errors in the use of the heater has only been taken into account by adding warnings to user instructions.

3.1.3 Family's actions to save themselves

As the fire developed, smoke spread from the sauna facilities to the side of the apartment, and at least one of the two smoke alarms went off. The mother of the family woke up, yelled something and possibly started to dress the children. The father got up from bed and saved himself by exiting the building via the door of the apartment and through the stairwell. The front door of the apartment remained open, and smoke spread into the stairwell. The mother and the children were left in the apartment.

A person in the stairwell had heard the sound of a smoke alarm but had not detected any other signs of fire. They did not recognise the dangerousness of the situation and therefore made no emergency call.

The apartment was decorated so that there was a large couch in front of the balcony door. This significantly impeded the readiness to exit the apartment through the balcony door in case of an emergency. The parents had not understood the emergency exit arrangements of apartment buildings or the importance of the balcony door for exit safety. The mother apparently did not understand how dangerous smoke was and how important it was to escape rapidly.

The induction of immigrants who have entered the country through family reunification to a new culture may largely remain the responsibility of the spouse. Even if an immigrant has been in Finland for a long time, the safety practices of everyday living and housing may remain unfamiliar to them.

3.2 Analysis of rescue operations

Several emergency calls were made on the fire. The emergency response centre made the first alarms quickly. It was difficult to establish an overall picture of the situation. The Emergency Response Centre and emergency medical care initially lacked a comprehensive picture of the number of people exposed, which delayed the alerting of ambulances.

The first rescue services unit to arrive was the first response unit. The rescue team reached the scene in nine minutes after the alarm, at which point effective rescue and firefighting

activities began. The five people left in the burning apartment could be moved out, but nothing could be done to save them.

The police patrol that arrived at the scene was the first authority to know that there were five people in the apartment. In the VIRVE network's multi-authority voice communications group, this information reported by the police did not reach the rescue services or emergency medical care. In the multi-authority voice communications group, some messages may be lost under other radio communications. Non-targeted information does not necessarily reach those who need it.

The capabilities of the first response unit are not sufficient to initiate effective search and rescue operations in building fires. A lot of new buildings have been constructed in Central Uusimaa area in recent years. This has significantly increased the number of risk grid squares in risk category I. Improving operational readiness to respond to the risks requires new resources and, among other things, the construction of new fire stations, which is slow.

4 CONCLUSIONS

The conclusions drawn include the causes of the accident or incident under investigation. The cause refers to different factors behind the incident and the direct and indirect factors contributing to it.

1. The timer switch of the heater was turned in such a manner that the switch remained in the timer preselection zone for timed switch-on. The person who had turned the controls had not understood that the heater would be switched on after the preselected time on the timer has elapsed.

   Conclusion: *Many heaters are easy to switch on because there is no child lock mechanism or other safety features that would prevent unintentional use. The heater may not have an indicator showing that it is on or that a delayed switch-on has been activated.*

2. The sauna stones had probably not been rearranged or replaced for years. The stones being wedged against structures and pressed together, and their disintegration obstructed the air circulation through the stone space, and the heat produced by the heat elements was not transferred to the sauna room as intended. The heater heated up significantly and caused the panel wall behind the heater to ignite.

   Conclusion: *The importance of rearranging and replacing sauna stones in the sauna heater for fire safety has not been sufficiently recognised. There is no working practice for rearranging the stones.*

3. The technical and structural solutions for the heater in accordance with the safety standard for electric saunas heaters did not prevent the heater from overheating and the wall surface from igniting.

   Conclusion: *The safety of electric sauna heaters is largely based on correct human activity, and thus errors in the use and maintenance of the sauna heater can have fatal consequences. The efforts to prevent errors or limit their impact is mainly based on the warnings in the instructions for use. Technical solutions related to them are not used to a sufficient extent.*

4. It is obvious that there were shortcomings in the knowledge and skills the mother of the family had on the safety of everyday life and housing.

   Conclusion: *Induction training for immigrants who have entered the country through family reunification is not always sufficient.*

5. The accident occurred in an area with recognised shortcomings in the level of preparedness of rescue services. Corrective measures had been initiated, but not all measures had been taken yet.

   Conclusion: *In areas with significant new construction, improving the level of readiness of rescue services to respond to increased risks requires new resources and, for example, the construction of new fire stations. This is a slow process.*

6. The Emergency Response Centre and emergency medical care initially lacked a comprehensive picture of the number of people exposed, which delayed the alerting of ambulances. The first police patrol to arrive at the scene relayed the correct number of people exposed in the VIRVE network's multi-authority voice communications group. This information was lost under other radio communications.

   Conclusion: *Reception of critical information was not ensured by requiring acknowledgements.*

5 SAFETY RECOMMENDATIONS

5.1 Rearranging and replacing stones in the sauna heater

The sauna stones had probably not been rearranged or replaced for years. The stones being wedged against structures and pressed together, and their disintegration obstructed the air circulation through the stone space, and the heat produced by the heat elements was not transferred to the sauna room as intended. The heater heated up significantly and ignited the panel wall behind the heater, causing a fire.

The usual reasons given for the need to rearrange and replace sauna stones is that the sauna heats up faster, and it improves the operation of the heater, prevents premature breakage of heating elements and reduces energy consumption. It has also been noted that rearranging the stones prevents the risk of overheating. This safety aspect has not been given much attention.

The importance of rearranging and replacing sauna stones in the sauna heater for fire safety has not been sufficiently recognised. There is no working practice for rearranging the stones.

The Accident Investigation Authority recommends that

The Ministry of the Interior, together with various actors engaged in safety communications, highlight the importance of safe use of electric sauna heaters and regular maintenance for fire safety. [2025-S8]

One of the tasks of the Ministry of the Interior is safety communications, which means communications and guidance related to safety and accident prevention. The aim of the communications is to improve citizens' safety attitudes and competence to prevent accidents. It would be important to create functional practices that each owner and user of electric sauna heaters can implement.

Safety communications could include at least The Finnish National Rescue Association (SPEK), The Finnish Association of Fire Officers (SPPL) and the Wellbeing Services County Company Hyvil Oy, together with the rescue departments' partnership network.

Different property organisations could each communicate about the authority's instructions and good practices concerning the changing of sauna heaters. The Finnish Real Estate Federation and its owner Kiinteistömedia Oy have traditionally played a strong role in the preparation of instructions and practices related to housing. In rental housing, the Finnish Landlord Association, which represents private operators, and the Association of Finnish Cities and Municipalities, which represents the municipal sector, have expertise on the perspectives of rental housing. Similarly, the Finnish Home Owners' Association has expertise in the matter from the perspective of the owners of single-family houses. Other possible parties include Finnish Property Owners Rakli, Finnish Tenants and the Finnish Real Estate Management Federation.

5.2 Ergonomics and structural safety of sauna heaters

The chain of events that led to the accident began when the timer of the heater was turned on unintentionally. The controls of the heater were easily accessible to children and had no child lock mechanism. The mother may have noticed the situation and tried to turn off the heater after the children, but she was unfamiliar with the logic of how to use the heater.

The heater involved in the accident had been type approved according to the standard test. The technical and structural solutions used in the heater also complied with the requirements of the relevant standard. However, they were not sufficient to prevent the sauna heater from heating up excessively and the wall surface from igniting. The heater overheat protector intended as a safety device did not go off and, therefore, did not prevent the accident.

The safety of electric sauna heaters is largely based on correct human activity, and thus errors in the use and maintenance of the sauna heater can have fatal consequences. The efforts to prevent errors or limit their impact is mainly based on the warnings in the instructions for use. Technical solutions related to them are not used to a sufficient extent.

The Accident Investigation Authority recommends that

> *The National Electrotechnical Standardisation Organisation SESKO promote the safety requirements for electric sauna heaters provided in technical standards in such a manner that unintentional use of operating controls is prevented and their operating logic and ergonomics are improved. In addition, the structural safety requirements of the heaters shall be developed to avoid overheating of the heater and ignition of the surrounding structures, regardless of the actions of the user. [2025-S9]*

Sauna heater manufacturers are positioned to act faster in taking account of the risks arising from the functioning of the operating controls, inadequate heater maintenance and obstructed air circulation in the stone space than those developing the standards. It is also important that the overheat protectors are quick to react in case of errors.

5.3 Measures taken

Before the accident, a new Act on the Promotion of Immigrant Integration was adopted in spring 2023[58]. It entered into force on 1 January 2025. The Act repealed the Act on the Promotion of Immigrant Integration that was in force at the time of the accident[59]. According to the Government proposal[60], reaching parents staying at home with children in particular and their participation in integration services should be increased to better support the inclusion and employment of immigrant women and the integration of the entire family. According to the proposal, improving the integration and employment of immigrant women would also have both short-term and long-term impacts on the integration of children and young people. With reference to results of research studies, the proposal states that the preconditions for the integration of children with a foreign background could be improved by increasing the employment of their parents and by developing their language skills.

For instance, the new Act will increase the responsibility of municipalities for promoting integration. This will be done by enacting provisions that task the municipalities with

58 681/2023.
59 1385/2010.
60 HE 208/2022.

preparing an assessment of skills and service needs related to integration as well as an integration plan for a larger number of immigrants, also those outside the labour force, such as immigrants receiving child home care allowance.

VAV Palvelukodit Oy and other companies of the VAV Group have inspected the apartment saunas of all properties they own. In the property where the accident occurred, all original sauna heaters have been replaced with new ones. VAV has distributed multilingual instructions for the use of saunas to all its apartments with saunas and reminded its residents that the tenant is responsible for replacing the stones in the sauna heater.

The landlord of the property, the wellbeing services county of Vantaa and Kerava, has paid more attention to the saunas and sauna heaters of their rental amaprtments than earlier.

REFERENCES

Written references

Aarnivuo, S. (2023) *Vuokra-asunnon vastuunjakotaulukko – Vuokralaiselle* (in Finnish; Table on the tenant's maintenance responsibilities in a rental apartment). Finnish Landlord Association and Kiinteistömedia Oy.

Artesola, M. (2024) *Opas taloyhtiön asukkaalle* (in Finnish; Guide to the residents of housing companies). Second edition. Kiinteistömedia Oy.

Harvia Oy (2003) *Instructions for Installation and Use of Electric Sauna Heater*. M45, M60, M80, M45E, M60E, M80E, M90E.

International Electrotechnical Commission (1997) *Safety of household and similar electrical appliances – Part 2: Particular requirements for sauna heating appliances*. Second Edition. International Standard 60335-2-53.

Klein, G. (2008) *Naturalistic Decision Making*. Human Factors, 50(3), 456-460. Santa Monica, CA: Human Factors and Ergonomics Society.

Safety Investigation Authority (2017) *Fire that resulted in the deaths of four people in an apartment in Vuosaari, Helsinki on 9 December 2016*, Investigation report Y2016-05.

Rasmussen, J. & Svedung, I. (2000) *Proactive Risk Management in a Dynamic Society*. Karlstad, Sweden: Swedish Rescue Services Agency.

Ministry of the Interior (2012) *Pelastustoimen toimintavalmiuden suunnitteluohje* (in Finnish, with description sheet in English; Instruction for Planning the Operational Capability of Rescue Services). Publications of the Ministry of the Interior 21/2012.

Finnish Real Estate Federation & Finnish Real Estate Federation Uusimaa (2023) *Household's Maintenance Responsibilities*. Fifth edition. Kiinteistömedia Oy.

Finnish Real Estate Federation & Finnish Real Estate Federation Uusimaa (2024) *Taloyhtiön vastuunjako – Osakkaalle* (in Finnish; Maintenance responsibilities in the housing company – For shareholders). Revised 33rd edition. Kiinteistömedia Oy.

Ministry of Economic Affairs and Employment (2022) *Welcome to Finland*. MEAE guidelines and other publications 2022:3

Investigation material

1) Site investigation photographs, dimensions and other material
2) Weather information
3) Separate studies
4) Material from the Eastern Uusimaa Police Department
5) Emergency response centre recordings and incident report
6) Records and documents from the rescue services and emergency medical care
7) Documents from the Regional State Administrative Agency
8) Documents from the wellbeing services county of Vantaa and Kerava
9) Electricity consumption data from Vantaan energia
10) Documents and materials from the property owner
11) Material from Helsinki Rescue Department
12) Material from HUS Group
13) Material from the social and crisis emergency services of Vantaa
14) Material from the sauna heater manufacturer

SUMMARY OF COMMENTS RECEIVED ON THE DRAFT INVESTIGATION REPORT

The draft investigation report was submitted for comments to the Ministry of the Interior, the Ministry of Social Affairs and Health, the Ministry of Economic Affairs and Employment, the National Police Board, the Emergency Response Centre Agency, the regional state administrative agency for Southern Finland, the Finnish Immigration Service, Vantaa and Kerava wellbeing services county, the Central Uusimaa Rescue Department, the Helsinki City Rescue Department, Eastern Uusimaa Police Department, Finnhems Oy of HUS Group, Harvia Oyj, the Finnish Real Estate Federation, Kiinteistömedia Oy, SESKO ry, VAV Yhtymä Oy, and those involved in the accident. Pursuant to the Safety Investigation Act, statements from private individuals are not published.

According to the information of the **Regional State Administrative Agency for Southern Finland**, rescue departments in the Uusimaa region have improved and developed safety training related to integration since the Vuosaari fire (2016) and developed this in cooperation with, for example, the ELY Centre. Learning material has been created for safety training, which contains basic information on seeking assistance in Finland and the fire safety of Finnish homes. The aim has been that at least all those participating in Finnish language courses in integration would receive this safety training. The Regional State Administrative Agency does not have an accurate situational picture of how this training has continued and progressed in the wellbeing services counties. However, the foreign-language population has been identified as an important target group in the joint risk analysis of the Uusimaa rescue departments.

The Finnish National Rescue Association also already has plenty of existing material to promote the housing safety of immigrants. Information related to the safety of sauna heaters could easily be updated in SPEK's electronic safety cards, which already contain a card related to electrical safety. The card in question does not contain safety instructions related to electric sauna heaters, but instructions related to the sauna can be found on the fire safety card.

The Regional State Administrative Agency pointed out that the Finnish Association of Fire Officers is also one of the key actors in safety communications.

In addition, the Regional State Administrative Agency presented a specification on the definition of the problem grid square in the draft investigation report.

In its comments, the **Central Uusimaa Rescue Department** presented one clarification on the number of rescue department units that are in immediate departure readiness.

The **Helsinki City Rescue Department** would have appreciated a more detailed consideration of the alerting and managing of rescue operations, as well as on the actual rescue operations in the draft investigation report.

In its comments, **the Finnish Real Estate Federation** states that the first recommendation on safety communications included in the draft investigation report is extremely important. As a competent authority, the Ministry of the Interior, together with various actors engaged in safety communications, can effectively provide instructions for the safe use of electric sauna heaters and their regular maintenance.

According to the comment, the recommendation in the draft investigation report on the practices of sauna stones replacement should be addressed to various organisations in the property and construction sector. The recommendation should not, however, be addressed to Kiinteistömedia Oy, which operates on commercial grounds. The recommendation should not

be phrased as a joint obligation. Instead, each target organisation should primarily be responsible for actions in accordance with the recommendation for its own part.

The Finnish Real Estate Federation notes that the Finnish Real Estate Federation does not have the necessary technical expertise in the operation of sauna heaters and the prevention of related fire risks, and thus does not have the resources to create effective practices. The Finnish Real Estate Federation proposes that the recommendation on the preparation and communication of instructions and practices be primarily addressed to the Ministry of the Interior so that the ministry can cooperate with actors engaged in safety communications.

The Finnish Real Estate Federation is happy to assist in communicating official instructions and good practices to its members and the housing company sector in a wider sense. The Finnish Real Estate Federation has various means of communicating instructions and practices. We can utilise, to an appropriate extent, for example the Finnish Real Estate Federation's telephone services, website news, training services and media cooperation (including press releases, opinion pieces and other newspaper articles, blogs, TV and radio interviews).

Finally, the Finnish Real Estate Federation asks the Safety Investigation Authority to consider the need to issue a separate recommendation to the Confederation of Finnish Construction Industries RT to communicate to its members the need to ensure adequate instructions for the use and maintenance of new dwellings also concerning sauna heaters.

In its comments, **Kiinteistömedia Oy** drew attention to the recommendation in the draft investigation report concerning the practices of sauna stones replacement. According to the comment, the recommendation should be addressed to all parties highlighted in the justifications, i.e. the Finnish Real Estate Federation and Kiinteistömedia Oy, as well as the Finnish Landlord Association, the Association of Finnish Cities and Municipalities and The Finnish Home Owners' Association. These organisations each have their own publication activities and communication channels that reach the stakeholders of the organisations in question in a significantly wider scale than Kiinteistömedia Oy. Organisations can utilise, to an appropriate extent, for example the telephone services, website news, training services and media cooperation (including press releases, opinion pieces and other newspaper articles, blogs, TV and radio interviews) that are not part of the product and service selection of Kiinteistömedia Oy. The main target and user group of Kiinteistömedia Oy's publications are primarily employees of property management companies, experts in the property and construction sector (e.g. lawyers and building technology professionals) and the boards of housing companies.

In addition, the organisations mentioned in the recommendation should take care of measures in accordance with the recommendation within the framework of their current activities. Kiinteistömedia Oy drew attention to the recommended operational guidance, according to which the Finnish Real Estate Federation and Kiinteistömedia Oy should jointly ensure that effective practices are created for the replacement of sauna stones. In this respect, Kiinteistömedia Oy stated that it does not have the necessary technical expertise (and as Kiinteistömedia Oy sees it neither does the Finnish Real Estate Federation, who owns the company) in the operation of sauna heaters and in the prevention of the related fire risks, and thus no resources for determining effective practices.

In addition, Kiinteistömedia Oy pointed out that it does not have separate financial resources for communicating common-good information, in accordance with the recommendations. Instead, the company carries out publishing of guides and information services for housing companies on commercial grounds. Of course, it is possible and desirable to consider effective

fire risk prevention practices, in accordance with the recommendations, in publications published by the company in the future, when this is natural and appropriate from the perspective of the topic and purpose of the publication. It should be noted that in all its publishing activities, the company depends on the fire safety experts available as content creators at any given time - they may also work for the authorities and private companies in addition to organisations in the sector.

Kiinteistömedia Oy proposed that the recommendation on the preparation and communication of instructions and practices be primarily addressed to the Ministry of the Interior so that the ministry can cooperate with actors engaged in common-good safety communications, mainly organisations in the field.

In its comments, **SESKO ry** notes that SESKO has been paying attention to the prevention of electric sauna heater fires for more than 30 years and has proposed a number of amendments to both the global and the corresponding European standard. Unfortunately, however, the latest edition of the EN standard has not been brought into a harmonised standard due to the hastiness of EU legislation.

The standard requires that the manufacturer's instructions for use provide instructions for piling the stones, but it does not require a mentioning of stone replacement. The standard requires heater protection devices to prevent overheating and these are subject to type tests compliant with the standard. These requirements have already been in the 1997 edition of the standard. After the accident, the heater causing the fire had been found not to have discharged the overheating protection. The draft investigation report did not explain why it did not go off.

We consider it possible to propose that the requirements for the user instructions of the standard should include an annual inspection of the stone space, regarding the condition of the stones and possible structural changes to the heater. It is very difficult to determine a structural requirement to ensure the intended air circulation, as safety standards do not take a stand on, for example, the shapes of structures and similar issues. After the type of heater in the accident in question, the requirements for safety and protective devices have already been tightened in two newer editions of the heater standard. The tests set out in the standard confirm that the safety devices function as intended even under abnormal operating conditions.

The importance of rearranging and replacing sauna stones for fire safety has not necessarily been sufficiently recognised, and SESKO can contribute to this by providing information, but our information is unlikely to reach the end consumers. The structural requirements and type tests specified in the standards ensure the electrical and fire safety of sauna heaters, but electrical equipment always involve the risk of operator actions if instructions are not followed. The aim is to minimise these risks by providing information.

The draft investigation report correctly states that the standard for electric heaters was updated in 2023, when amendments to the standard were published. One of them requires that the heater must have a clear indication when it is switched on or a delayed start is activated. Instead, the statement in the draft investigation report that "Broader security features such as child safety locks are not required in the standard" is incorrect. As a result of the new requirement in the standard, heaters that meet the requirements of the standard must, in addition to indication, have a structural requirement that two separate measures are required to activate delayed start.

The draft investigation report mentions that the safety of electric saunas is largely based on the correct functioning of humans. Preventing errors or limiting their effects is mainly based

on warnings in the user instructions, and the related technical solutions are not sufficiently used. The aforementioned points are not quite correct as regards the fact that safety requirements would not be laid down in the standards. There are four editions of the electric sauna heater standard and a fifth edition is being prepared. The safety of electric sauna heaters has been continuously improved from one edition of the standard to the next, and the latest safety-enhancing requirements have been included in the standard with amendments published in 2023.

The SESKO expert group, including representatives of device manufacturers and safety authorities, is examining the IEC proposal currently being voted on and, if necessary, will propose amendments to the European version that SESKO is still able to influence at this stage. SESKO anticipates and strives to eliminate the risks that may be encountered in the future, for example from remote starts, heaters mounted behind a wall or heaters equipped with air circulation (fans and other accessories). Requirements for these applications are already laid down in the latest edition of the sauna heater standard.

SESKO notes that the recommendation addressed to SESKO in the draft investigation report recommends preventing unintentional use of operating switches. Unintentional use has already been prevented with the latest standard update. Naturally, it will take time for the heaters that meet the latest standards to become more common in the field. However, that statement could be deleted from the recommendation.

SESKO will continue its active efforts to improve the safety of electric sauna heaters, as SESKO has Finnish expertise at its disposal and it can propose changes to international and European standards, as it has done so far. The expert group continuously discusses the safety of electric sauna heaters and takes initiatives to develop global and European standards, as well as to improve the safety of electric sauna heaters. Based on the discussions and proposals made in the expert group, various actors can contribute to promoting the safety of electric sauna heaters as far as possible.

In its comments, **VAV Group Ltd** presented clarifications to the Group's structure, the relationships between the property owner and VAKE, which is responsible for lessor activities, and the content of instructions for residents.

The Ministry of Social Affairs and Health, **National Police Board of Finland**, **Eastern Uusimaa Police Department** and **Finnhems Oy** reported that they do not have anything to comment on the draft investigation report.