

Impact of chimney sweeping on protection of life and property

Abstract:

Driven by a desire for prevention, inspired by the fire disasters of the past, chimney sweeping, known as the profession of life and property safety, was one of the first to be born a long time ago. The chimney sweeping industry, which is nowadays responsible for ensuring the fire safety of homes in accordance with the legislation and, to this end, works in conjunction with the official inspection system of the fire safety administration, has followed in the footsteps of this profession, which was once practiced according to principles based on tradition.

In view of the expected escalation of the crisis due to artificial restrictions on access to energy sources, the chimney sweeping service for residential property is facing serious challenges. The author gives a detailed insight into the professional implications of these energy reversals for homes and the apparent shift towards fossil raw materials.

Keywords: chimney sweeping, combustion equipment, fire products, safety, fire protection.

A kéményseprés hatása élet- és vagyonbiztonságra

Kivonat:

A múlt tűzkatasztrófaiból táplálkozó megelőzés szándéktól vezérelve, már igen régen az egyik legelsők között született meg a lakosság élet- és vagyonbiztonságát szolgáló szakmaként ismert kéményseprés. Ennek az egykori tradíciókon alapuló elvek szerint gyakorolt szakma helyébe lépett a napjainkra a jogszabályi előírások szerint az otthonok tűzbiztonságát szavatolni hivatott, és az ennek érdekében a tűzvédelmi igazgatás hatósági felügyeleti rendszerével karöltve dolgozó kéményseprőipari tevékenység.

Az energiahordozók hozzáféréseinek mesterséges korlátozása nyomán kialakult válság várható fokozódása miatt komoly kihívásokkal kell számolnunk a lakossági ingatlanállomány kéményseprőipari kiszolgálása tekintetében. Az említett, az otthonokat érintő és a láthatóan fosszilis nyersanyagok irányába történő energetikai visszarendeződések szakmai kihatásainak részleteibe enged bepillantást a szerző.

Kulcsszavak: kéményseprés, tüzelőberendezés, égéstermék, biztonság, tűzvédelem.

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Introduction

We know from our historical studies that the relationship between fire and man is of particular importance for the rise of our civilization, because the mastery of this natural force has given us a significant evolutionary advantage. One of the important benefits associated with this evolutionary step was that it enabled settled man to create a stable living space in his dwelling, which was also secure against environmental adversities.

However, it also brought them into close proximity to the threat of fire when they brought it into their permanent accommodation. This posed an even greater threat with the emergence of buildings that were completely enclosed by enclosures, which were often surrounded by walls in the city-states of the Ancient World. Especially with the later development of the Kia in large cities, where the houses of the population, built in close proximity to each other, allowed almost unlimited fire spread in the event of a fire outbreak. [1]

As the historian states, here "*People lived in total vulnerability to fire*". This is so true that the threat of fire posed by combustion appliances and flue gas ducts has also fundamentally shaped the mindset of people who feared for their homes. [2]

This is evidenced by the life drawing of people fighting a chimney fire, shown in picture 1, which is hidden in a very detailed and respectable-sized detail of a painting by the medieval German Lowland painter Pieter Bruegel the Elder.



Photo 1.: Reflections of chimney fires in the minds of medieval people by Pieter Bruegel the Elder [3]

"Neglected and uncleaned chimneys were the main cause of urban fires in the Middle Ages, and a new industry was already developing and growing: chimney sweeping. Chimney sweepers cleaned the flue systems, sooted the combustion appliances and also served the population as preventive fire department." [4]

However, in the early days of the fire police, the masters of the guilds of the various fire mesterries, etc., were obliged to extinguish the fires and keep the necessary equipment ready, thus sharing the work. However, fires in dwellings were still a very frequent and tragic occurrence. The painting below, which is in the possession of the Fire Museum, commemorates the aftermath of just such a fire. [5]

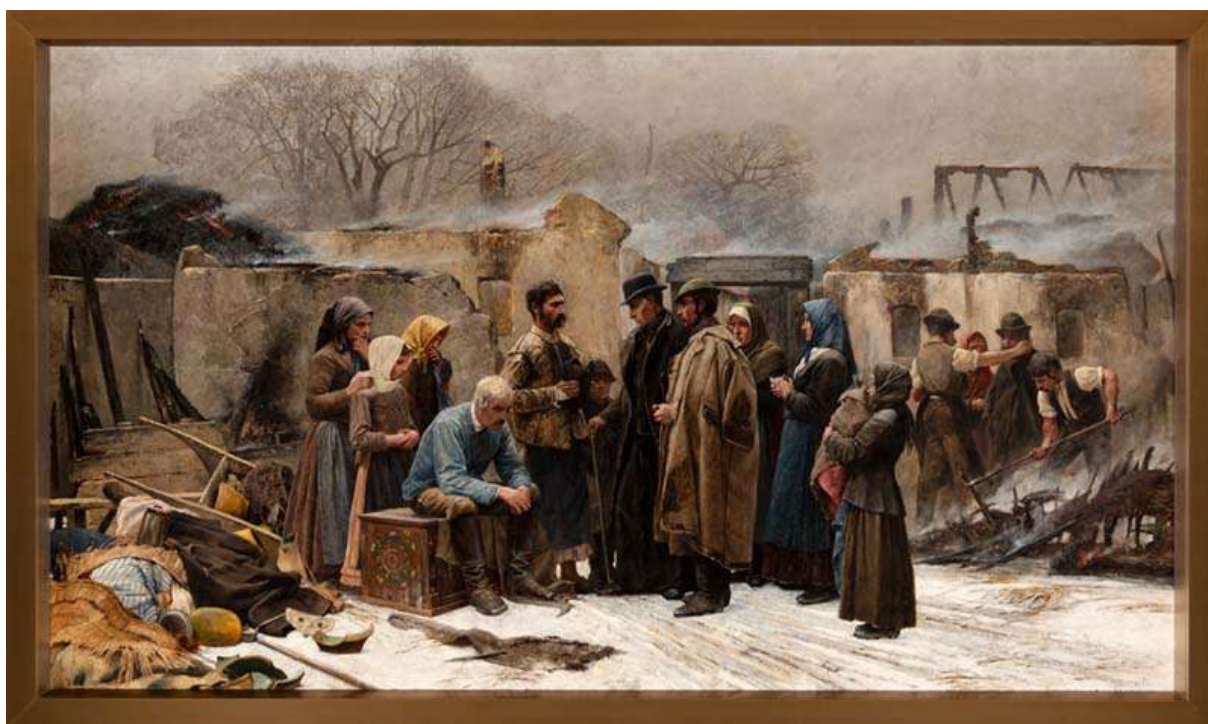


Photo 2.: Artistic representation of the victims of conflagration Árpád Feszty [6]

However, modern technical innovations and modern life have significantly changed the structural design and fire safety of residential buildings. Among them, fire engineering systems have been given a high priority, as in recent years, ever more expensive energy sources have brought sustainability and energy efficiency to the fore. However, the current energy crisis has seen more and more people switching back to mixed fuel heating, which is increasing the number of homes returning to biomass fuel heating systems.

However, this is not always coupled with good operation and maintenance practices or the use of fuels and heating equipment, which can lead to a number of risks. It is therefore essential that the technical condition of chimneys and combustion equipment is regularly checked by a chimney sweep. [7]

Residential chimney sweeping for fire safety in homes

Chimney sweeping is not simply a routine maintenance job, but rather a fire safety activity for the safety of the public. Residential combustion appliances are dangerous pieces of equipment that can create fire hazards in dwellings. This is not to mention the widespread fires that can affect entire neighborhoods because of damage to buildings caused by natural disasters and the resulting damage to equipment.

From an engineering point of view, the assessment of the fire risk is a complex issue, even for fires that spread freely. In this context, the combustion plant and the technical and structural elements connected to it are additional aspects to be assessed. For the latter, one of the most important is compatibility with the combustion system. The starting point for this is the technical plans, which, under national legislation, cannot enter the construction phase without technical consultation with the chimney sweep.

The most important criteria for issuing a chimney sweep consent are the thermal performance of the planned combustion plant and the adequacy of the flue gas discharge and the air supply to be provided in accordance with this.

Another important element of the chimney sweep assessment of the design is the roof envelope and the design of the structural connections between the chimneys to protect them from possible fire spread. This usually involves a review of the plans in the office of the chimney sweep service provider in practice. This of course requires considerable expertise, not only in the interpretation of technical plans but also in practical experience. As can be seen from Figure 1, fire damage statistics show that chimney fires pose a real threat to residential properties.

The next important stage in the technical condition assessment is the post-construction technical acceptance, which should include, as a legal requirement, a chimney sweep's on-site inspection of the chimney's installation plan, including a site visit by a chimney sweep. This is not unimportant because, unfortunately, experience has shown that there are often discrepancies between reality and plans.

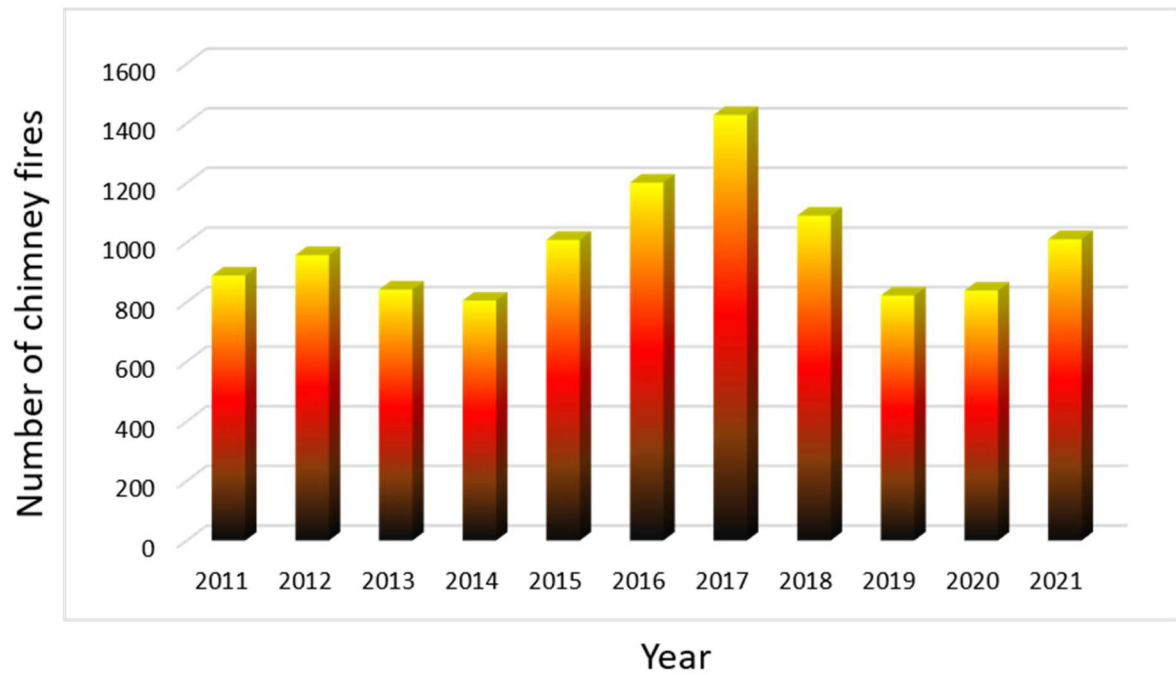


Figure 1.: Annual trends in the number of chimney fires in Hungary, edited by the author based on NDGDM [8]

As regards the interpretation of the statistics, it should be mentioned that fires where there is no fire in the chimney and only fires on combustible building structures heated to the extent of their heat of ignition by direct convective heat transfer or heat conduction from hot combustion gases flowing in the chimney are not included. Although the latter can also cause serious fire damage. Particularly dangerous are those which start from the ignition of the roof structure, rafters, coils, or other utility or fittings in the chimney, or which ignite the surrounding materials through contact with the metal structures of the flue or chimney or through thermal radiation. Conversely, the consequences of chimney fires spreading to building structures by flame propagation can be at least as serious.

The fire statistics on the occurrence of chimney fires primarily show that the combustion plant is not operated in accordance with the operating instructions, is not properly maintained, and is not maintained. In other words, typically tarry combustible deposits occur in the chimney flue, which is associated with an inappropriate choice of fuel. One of the most common problems is the presence in the combustion products of undried, wet firewood-derived fire ash constituents, the condensation of which causes tar formation. Where soot and tar deposits are formed in chimneys, the flow cross-section in the flue gas ducts may be considerably reduced, with the result that the reduced dynamic outflow will not be sufficient to deliver the flue gases to the environment, so that they will flow back through the combustion plant to the interior, creating a risk of poisoning.

Another reading of the occurrence of chimney fires in residential buildings is that there is a significant correlation between the population concerned and its low social and socio-economic status. The basis for this is identified from a synthesis of the evidence that indicates that the high moisture content firewood that typically induces chimney fires and is unsuitable for use as fuel in the combustion system is usually obtained from illegal logging. It is precisely in such cases that indiscriminate felling and use without drying due to rapid abandonment of the site are typical. This occurs primarily in an extensively afforested mountain and floodplain forests and in areas with a significant number of settlements with disadvantaged populations. This correlation is illustrated in Figures 2 and 3, which show the local distribution of chimney fires and the spatial distribution of illegal logging in Hungary, based on official data.

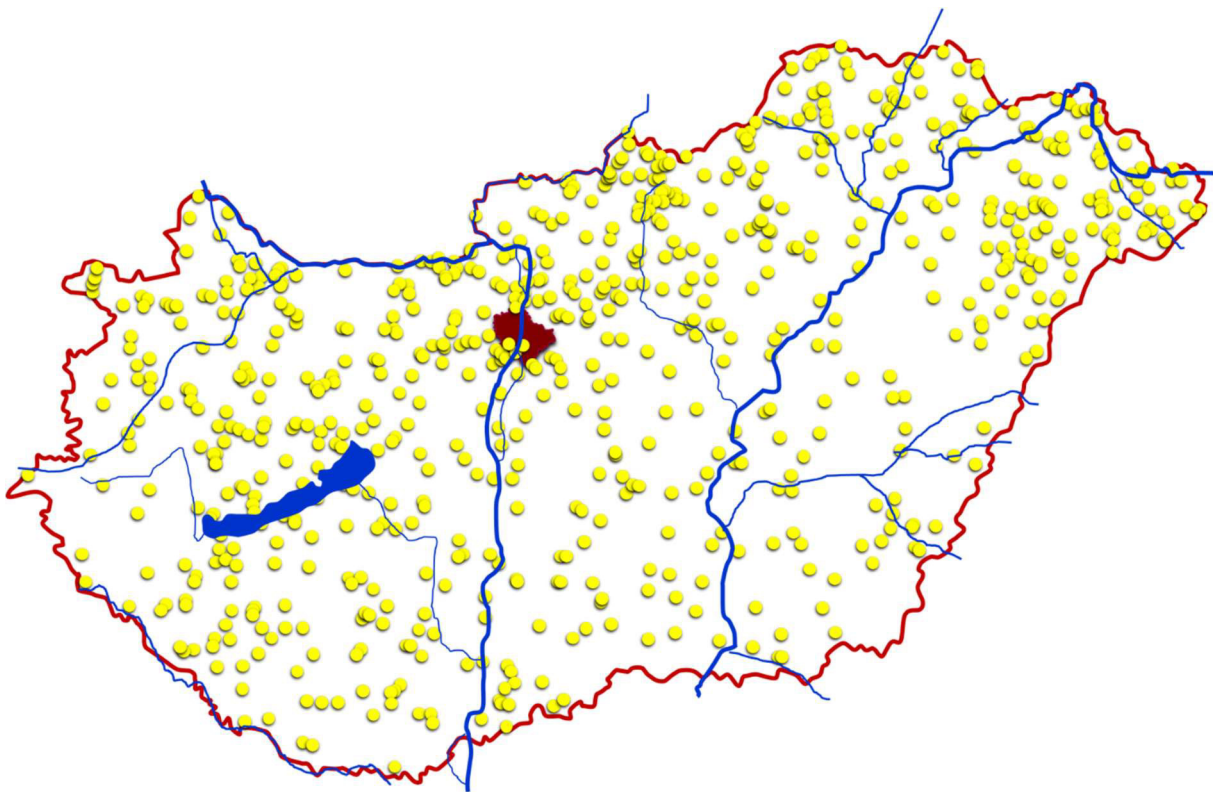


Figure 2.: Report on the local distribution of chimney fires in Hungary in 2019, edited by the author based on Bérczi [9]

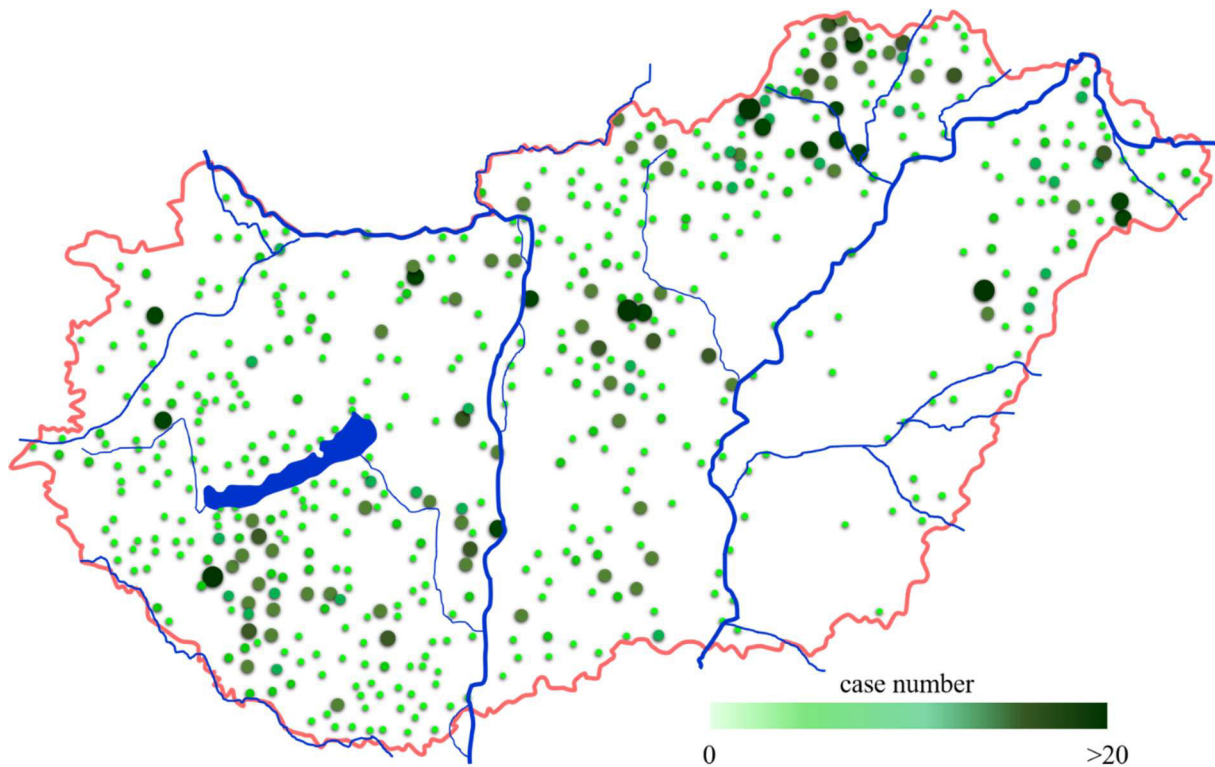


Figure 3.: Hungarian municipalities affected by illegal logging 2016-2020, edited by the author based on NFCSO (2021) [10]

The illegal purchase of poor-quality firewood, which is the cause of chimney fires, is, therefore, an indirect consequence of the economic and social disadvantage of the people living in the affected settlements, which is confirmed by the analyses of the statistical office. This is particularly marked where forested areas overlap with low levels of economic development, for example in the north, northeast, and certain south-western regions of the country. As can be seen in the map sketch in Figure 4, based on the analysis of the spatial distribution of income indicators reflecting the existential situation in Hungary, which is based on the analysis of the social and social situation in Hungary by the Central Statistical Office. Of course, the distribution of income is not even within each county. Within these counties, too, there are very wide income disparities. These are also clearly visible in the pattern of the distribution of illegal logging in the municipalities. In these settlements, there are more disadvantaged and extremely low-income minority communities with a larger number of inhabitants.

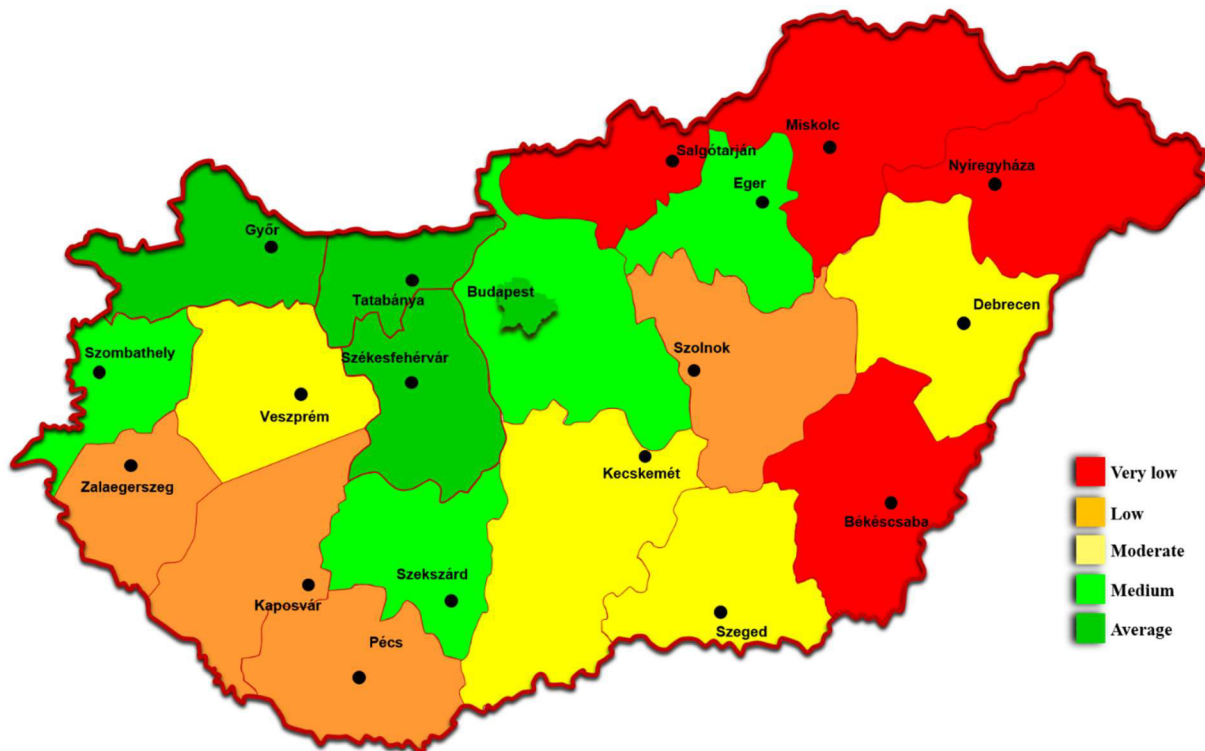


Figure 4.: Monthly average net salary, edited by the author based on CSO (2021) [11]

The role of chimney sweeping in preventing carbon monoxide hazards

Heating systems in dwellings are not separate technical installations. They are only one element, albeit a decisive one, of the overall heating system, which, together with the connected flue gas ducts, forms a complete system. They can only be operated safely and efficiently if each element is professionally constructed and regularly maintained.

The vital importance of this latter factor is particularly evident in the case of accidents involving fatal carbon monoxide poisoning. From a basic combustion theory point of view, the safety of the combustion plant from this point of view is primarily determined by the adequacy of the oxygen supply. Its absence can be particularly critical in the case of old, still widespread open-combustion combustion plants. These can occur in living areas with interstitial airflow for several reasons. These may include the combined use of extractor fans, chimney blockages, or the retrofitting of modern windows with increased air tightness, which may cause more severe life-threatening conditions due to the backflow of toxic combustion products than any other cause, as illustrated in Figure 5. [12]

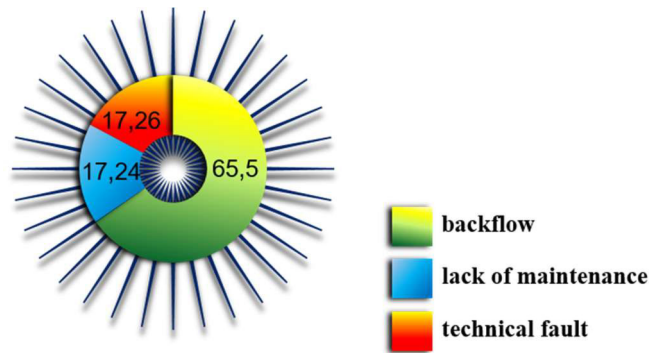


Figure 5.: Causes of carbon dioxide poisoning, edited by the author based on the database of chimney sweeping service

The causes described above lead to an increasing number of dangerous events each year, as illustrated in Figure 6. Although there appears to have been a noticeable increase in the total number of incidents, the number of fatal carbon monoxide poisoning has nevertheless decreased.

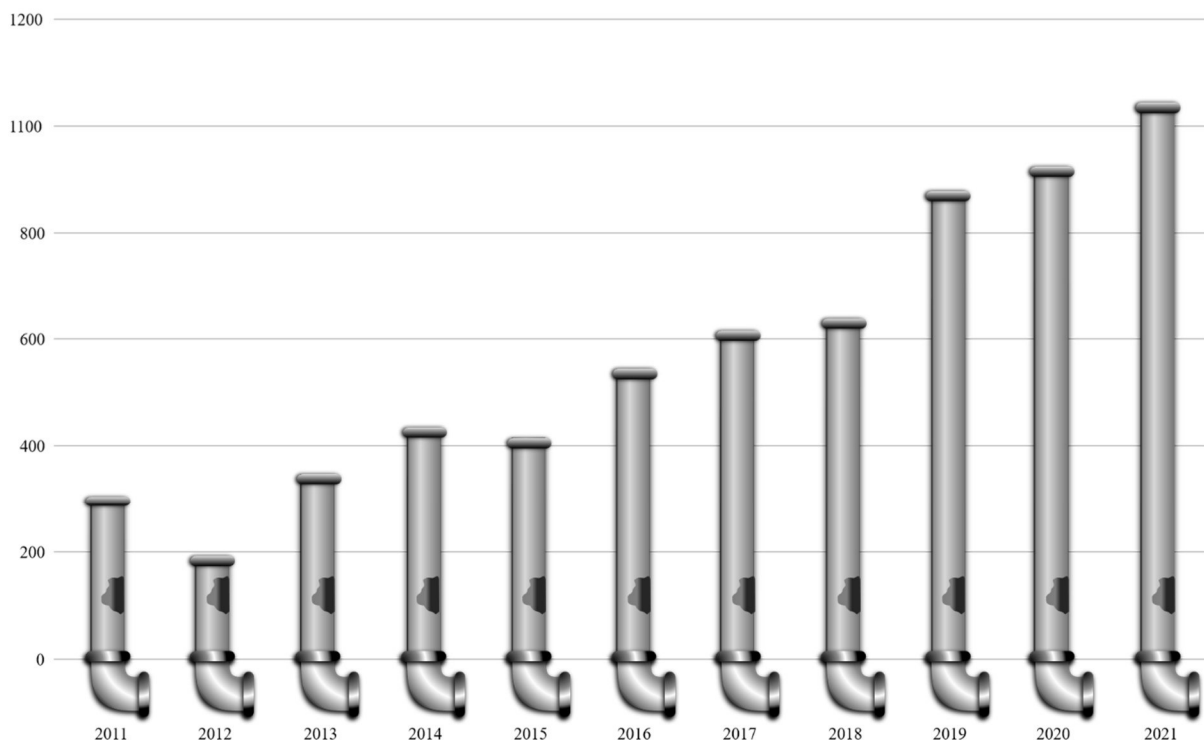


Figure 6.: Carbon monoxide events, edited by the author based on NDGDM [9]

Although accidents are a sign of the increased risk posed by increased air-tightness of windows and doors, they are the rarest occurrence when windows and doors are replaced professionally and the air exchange elements are left open. Safety can be further enhanced by installing a carbon monoxide detector with appropriate technical criteria in rooms with the such an air-air interface. This simple and inexpensive device, in addition to being required by law to be installed, is being increasingly used by the public thanks to promotion campaigns carried out

under the auspices of the National Fire Prevention Committee, set up in cooperation with social organizations and municipalities involved in fire prevention, as shown in Photo 2. Despite the increase in incidents caused by carbon monoxide, the decreasing number of poisonings is clear proof of the success of these efforts.



Photo 3.: Public campaign on milk cartons of National Fire Prevention Committee [13]

Yet safety is best served by ensuring that combustion gases are vented through a modern, sealed combustion chamber and associated flue gas outlet. In this way, backflow cannot occur because it is not connected to the living space and is discharged into the open air by a fan installed in the gas appliance. Oxygen for combustion is also drawn from the outside by the chimney.

The other important technical problem is the group of common so-called collector chimneys built in the preceding decades in multi-family dwellings, typically in urban housing. These are designed in such a way that even minor integrity defects can easily lead to the leakage of dangerous combustion products into flats without a combustion system. It should be noted that these buildings, which were typically built before the introduction of modern building technologies and are up to a hundred years old, are typically constructed with small masonry elements, which are no longer permitted, and their technical condition is therefore understandably very rarely reliable. Moreover, in the case of these chimneys, the sealing of certain unused wall openings in the chimneys has often been carried out without any technical documentation, and it is far from certain that they have the required smoke density. Chimneys must be designed and installed in a safe manner, meeting complex requirements in terms of combustion, electricity, and fire safety. This is the only way to guarantee that the chimneys can

be operated safely in the future under intensive and highly stressed conditions of thermal and corrosive use.

The integration of the new organization itself involved a great deal of organizational work, and once it had been completed, many of the issues that had previously taken up considerable energy could be managed by the organization's management structure, which was subsequently significantly changed.

A significant number of the chimney sweepers who had been working until then continued their professional work in the new organization, the initial composition of which is shown in Figure 8. The organization implementing the integration has made up for the temporary shortage of staff in certain categories by introducing a new chimney sweep apprenticeship in its own training system, i.e., by launching master's courses in cooperation with the Chamber.

The chimney sweep body, which has thus taken up its duties, is staffed by chimney sweep specialists assigned to the regionally structured supply chains and has already established effective operational practices with all the partners involved, from the municipalities to the public authorities, during the period of its establishment.

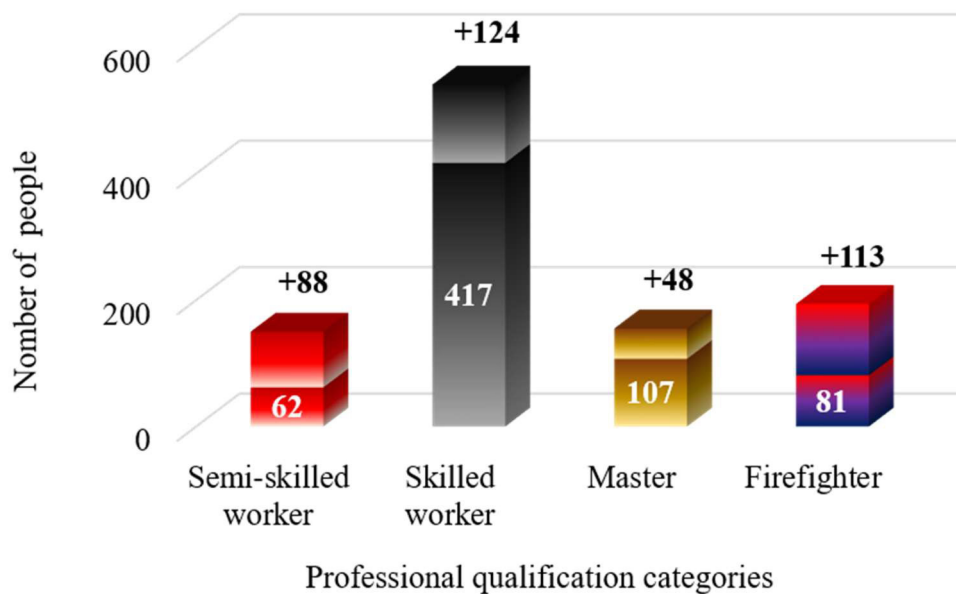


Figure 8.: Human sources of chimney sweeping, edited by the author based on NDGDM [14]

The fact that the restructuring has made chimney swept work free of charge has relieved the service in the municipalities concerned with the professional and quality of care difficulties caused by the profit motive. Although some in the profession argue that the abolition of the compulsory nature of public service shortly afterward does not reinforce the desire to increase the security of life and property, the fact that the service is no longer compulsory is a counter-argument.

However, the professional disaster management organization, which is responsible for the safety of the service of most chimneys in Hungary, is committed to enhancing the safety of life and property of the public in the chimney sweeping industry, both in terms of chimney sweeping and in terms of the supervision of the chimney sweeping industry.

Unfortunately, however, it is a serious question whether the current chimney sweeping industry will be able to meet the challenges posed by the expected increased rate of installation of solid fuel-fired plants in the wake of the current energy crisis. Given the expected demand on the residential sector for the capacity available to it, which is expected to be much higher than at present. This will have an impact on the safety of life and property of the population in the coming period of energy scarcity, in addition to the environmental air pollution situation.

Conclusion

The increased demand in recent months for discounted domestic firewood to address domestic energy difficulties also indicates that many people are abandoning their conventional heating systems and switching back to solid fuel heating technologies. However, this also carries a serious risk, given the dangers posed by chimneys that may have been neglected for many years. During the heating season, the number of chimney fires and the resulting fires among users of solid fuel firing systems is often very high. The structural reorganization of chimney sweeping services in the residential sector also means that fire protection professionals and chimney sweeps need to pay more attention and campaign to convince citizens to protect their own fire safety. The worrying signs that this is the case are already being reported with increasing frequency. Chimney sweeps visiting homes can also directly help to improve the technical safety of household combustion appliances and their associated flue gas outlets, and thus reduce the number of fires.

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