

Causes of Odor in Kitchens, Bathrooms, and Toilets of Multi-story Residential Apartments with Natural Ventilation

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Abstract: The causes of an offensive odor in the kitchens, bathrooms, and toilets of residential apartments in multi-story buildings with natural ventilation in Tomsk, Russia, are discussed in this paper. This problem exists in other cities and countries. Wall electric fans can be installed in ventilation grills in kitchens, bathrooms, and toilets of apartments in multi-story residential buildings. Typically, these fans turn on with the light in the bathroom or toilet, so the problem is periodic. Forced airflow from a fan in one apartment disrupts the natural outflow of air in the ventilation system of a residential building designed and built according to building codes and regulations and can cause an unpleasant smell in neighboring apartments. In many cases, it is difficult to determine which apartments have fans and force the neighbors to remove them. Locally, on the scale of one apartment, the problem is solved by installing an air check valve in the ventilation grill, which will block the nuisance airflow from the ventilation system into the bathroom. Globally, the problem is solved by modification and subsequent compliance with building codes and regulations, the implementation of which is controlled by local authorities.

Key words: Ventilation, ventilation fan, sewage gas, check air valve, health safety, public health.

1. Introduction

The years 2020-21 were marked by an epidemic of coronavirus infection, to which the authorities of many countries responded with long-term mandatory self-isolation of citizens, lockdowns, and all kinds of travel restrictions. In many countries, including Russia, people were forced to stay in their apartments and not go out for days and weeks [1]. Scientists have found that COVID-19 can be transmitted through ventilation systems [2]. Other viruses and pathogens are also spread through ventilation systems [3], which can make self-isolation and quarantine measures less effective.

Electric fans designed to be inserted into the ventilation grills in bathrooms and toilets are available on the market. Fig. 1 shows a wall-mounted fan installed in the toilet vent of an apartment on the 3rd floor of a 9-story residential building in Tomsk Russia.

There was a strong tobacco smoke smell in the toilet in the mornings, and periodically sewage smell. Fig. 2 shows a wall fan installed in the bathroom of an apartment on the 9th floor of a 10-story residential building. Covered by the smell of shampoos in the bathroom, there was a sewer smell. The author noticed an extraneous odor in several bathrooms and toilets of apartments in the city of Tomsk in the summer of 2021 and 2022. The problem of nuisance smell in kitchens, bathrooms, and toilets is present in other Russian cities, including Moscow. There are similar problems in other countries, especially in China and Thailand, but perhaps due to other reasons.

2. Results and Discussion

The sewerage smell is present in many residential apartments in China [4], mainly because the apartments are sold unfinished and plumbing fixtures are not

always installed by licensed professionals. As a result, sewer pipes are not always sealed, and plumbing fixtures do not always have siphons installed. Such a deplorable situation in China is due to the failure to comply with relevant building codes and regulations. In South Korea improved dampers have been proposed for the odor problem [5]. In Russia, the situation is different, since industrial and civil construction is initially carried out in compliance with building regulations, and ventilation systems are properly designed. The problems described in this paper appeared several years ago and did not exist in the Soviet Union. In Russia, the ventilation of multi-story residential buildings is mostly natural. In the US, there is no odor problem in the bathrooms and toilets of multi-story residential buildings. In the US, ventilation is forced, where powerful fans are installed in the basement and on the roof of a multi-story residential building, which suck the air out of the premises through the ventilation grills into the street, so installing individual fans does not make sense [6]. In Russia, fans can be installed during apartment renovations, as they require power wiring and are usually switched on with the room light. That is why the bad smell problem can be periodic.

In the summer of 2022, the problem of a nuisance smell in the apartment of a residential building in Tomsk was solved by temporarily sealing the ventilation grill. Fig. 3 shows the vent after the wall fan has been removed and the electrical wires insulated. In Fig. 4, the vent is temporarily sealed with a thick plastic film and adhesive tape. After this modification, the occasional smell of tobacco smoke and other unpleasant odors disappeared.

Temporary sealing of the ventilation showed that it was the source of an unpleasant smell periodically passed into the bathroom from other apartments. The problem was temporarily solved during the author's stay in the apartment for several weeks. However, completely sealing the vent in the bathroom for a long time leads to increased humidity and mold. Thus, this

is not a long-term solution, even on the scale of a single apartment. The ventilation of the bathroom was carried out into the hallway for several weeks, which was possible in the summer with the windows open.

Fig. 5 shows a fan with a damper that prevents air from flowing out of the vent. While such a damper fan will prevent odor from other apartments, the fan itself interferes with the entire natural ventilation system of



Fig. 1 Wall fan installed in the toilet of an apartment on the 3rd floor of a 9-story building in Tomsk.



Fig. 2 Wall fan installed in the bathroom of an apartment on the 9th floor of a 10-story building in Tomsk.



Fig. 3 The air vent in the bathroom of a residential apartment in Tomsk without a fan.



Fig. 4 Sealed vent in the bathroom of a residential apartment in Tomsk.



Fig. 5 Fan with a damper.

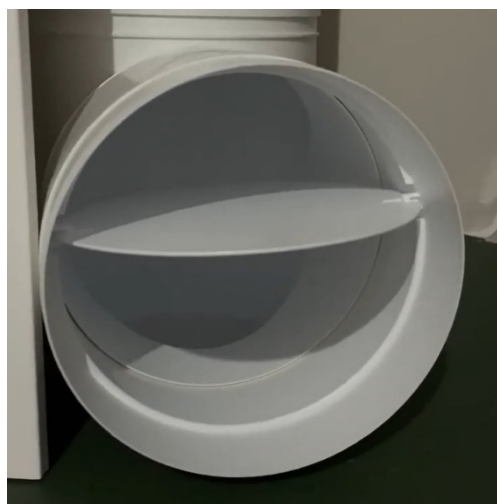


Fig. 6 Air check valve.

an apartment building. Forced airflow from a fan in one apartment disrupts the natural flow of air in the ventilation system of the entire residential building, causing an unpleasant smell in neighboring apartments.

Therefore, instead of a fan, a check valve needs to be installed in the vent, as shown in Fig. 6.

Apartment renovations are carried out by licensed contractors in the US. The license is issued by the state government and requires passing special exams. Before remodeling an apartment, it is necessary to submit architectural plans to the city authorities, which carry out inspections during and after the remodel. If the building code is not followed, the city authorities have the power to halt construction and take legal action against both the contractor and the apartment owner. At the end of all work, a fire inspection is carried out. Building codes in the United States require a fire damper to be installed in the ventilation system. In Russia, such strict requirements are not yet provided for by building regulations. Although the Florida Building Code specifies airflow specifications for ventilation systems in different rooms, the installation of fans in ventilation grilles is not prohibited [7] and is even required by building codes in the US in windowless bathrooms [8]. The same situation is with the Russian Building Regulations, which give a specification for the airflow during the ventilation of rooms of various purposes and sizes [9, 10].

3. Conclusions

The paper discusses the problems of odors in bathrooms and toilets in Tomsk, Russia. There are similar problems in other Russian cities. Extraneous odors are caused by the installation of electric fans in the ventilation openings of individual apartments. Fan operation disrupts natural ventilation, causing odors in other apartments. In one apartment, the problem is solved by installing a check air valve in the vent. Globally, the problem must be solved by modification and implementation of building regulations.

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