FACTS Reports

Field Actions Science Reports
The journal of field actions

Special Issue 21 | 2020
Indoor air quality: tackling the challenges of the invisible

Addressing indoor air pollution challenges through concrete public policies in South Korea

Dong Hwa Kang

OpenEdition Journals

Electronic version
URL: http://journals.openedition.org/factsreports/6141
DOI: ERREUR PDO dans /localdata/www-bin/Core/Core/Db/Db.class.php L.34 : SQLSTATE[HY000] [2006] MySQL server has gone away
ISSN: 1867-8521

Publisher
Institut Veolia

Printed version
Date of publication: 24 February 2020
Number of pages: 82-85
ISSN: 1867-139X

Electronic reference
Dong Hwa Kang, "Addressing indoor air pollution challenges through concrete public policies in South Korea", *Field Actions Science Reports* [Online], Special Issue 21 | 2020, Online since 24 February 2020, connection on 07 January 2021. URL: http://journals.openedition.org/factsreports/6141 ; DOI: https://doi.org/ERREUR PDO dans /localdata/www-bin/Core/Core/Db/Db.class.php L.34 : SQLSTATE[HY000] [2006] MySQL server has gone away

Creative Commons Attribution 3.0 License

ADDRESSING INDOOR AIR POLLUTION CHALLENGES THROUGH CONCRETE PUBLIC POLICIES IN SOUTH KOREA

Dr. Dong Hwa Kang
Associate Professor of Architectural Engineering Department, University of Seoul

Ventilation units on a building façade

In this interview, Dr. Kang illustrates some of the ways in which a country can address indoor air quality issues through legislation. Taking South Korea as a case study, the article explores the measures available to governments to ensure efficient control of indoor air quality, and to elaborate a plan for improvement going forward. Through a discussion on public-private interactions, the author shows that indoor air quality is a complex issue that requires an alignment of all policies, market forces and citizens in order to be managed appropriately. By and large, it is the dialogue and transparency between these different actors that ensures that good practices are promoted, and appropriate measures taken. While South Korea seems particularly advanced in orchestrating a response to air quality issues on a national scale, it is hoped that other countries will be inspired by the results achieved and follow suit by drafting innovative legislation on the topic.

Dr. Dong Hwa Kang is an Associate Professor of the Architectural Engineering Department at the University of Seoul (UOS). Before joining UOS in 2014, Professor Kang worked as a Postdoctoral Research Fellow at the Institute for Research In Construction of the National Research Council Canada and as a Postdoctoral Scholar at the Pennsylvania State University. He received his B.S., M.S and Ph. D degrees in Architectural Engineering from Seoul National University.

Professor Kang's current research interests focus on ventilation and air cleaning system design to minimize the adverse effects of indoor air pollution on occupants. His publications deal with numerical modeling of indoor pollutant emissions from building materials, contaminant transport and dispersion analysis in buildings, and the development of particle filtration systems integrated into a double skin façade in buildings. Professor Kang is a member of international and Korean professional associations including ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers), ISIAQ (International Society of Indoor Air Quality and Climate), KOSIE (Korean Society for Indoor Environment), AIK (Architectural Institute of Korea).

What are the main issues regarding indoor air quality in South Korea (types of pollutants, rate of fine particles, etc.)?

Dong Hwa Kang: For some years, the main concern in Korea regarding indoor air quality has been the existence of fine particles such as $PM_{2.5}$ and PM_{10}. The high concentration of fine particles in the atmosphere during spring and winter as well as issues relating to the management of indoor fine particles in residential buildings are attracting much attention from building companies and residents. According to a recent study[1] which investigated the impact of outdoor particulate matter on indoor air quality in Korean residential buildings, an indoor fine particle infiltration factor of 0.65 was measured for apartments in Korea[2], indicating that fine particles in the atmosphere significantly impact indoor air quality. Accordingly, the sales of air cleaners have been increasing, as people attempt to reduce indoor fine particle concentration levels.

Another central issue is the presence of radon[3] in apartments. The Ministry of Environment recently conducted a survey on apartments that revealed radon presence and raised the need for remedial action, leading to the creation of new management criteria for indoor air quality. In 2018, the recommended radon criterion for new apartments was newly set at 200 Bq/m³, and this restriction was reinforced to 148 Bq/m³ in July 2019. Generally, radon gas is known to enter buildings through cracks in underground structures, but the radon in Korean apartments is thought to come from building materials. However, there is no standard method for evaluating the radon exhalation rates of building materials, although efforts are being made to create such a standard.

According to you, what are the most effective measures that the Korean government has taken to tackle the indoor air quality issue? What are the latest evolutions in public policies?

D. H. K.: There is a strong interest in apartment residents' health and in apartments' asset value in Korea, which has stimulated the government to legalize strict management criteria for indoor air quality. Korea is one of the few countries in which indoor air quality is legislatively managed. For instance, the problem of Sick Building Syndrome caused by volatile organic compounds (VOCs) and formaldehyde in new apartments was addressed thanks to regulations such as the 2009 Housing Act[4] adopted by the Ministry of Land, Infrastructure and Transportation (MOLIT) and the Indoor Air Quality (IAQ) Act for Public Use Facilities[5] adopted by the Ministry of Environment (MOE).

In 2014, the government established the "Five-Year Basic Plan for Indoor Air Quality Management" to systemize management of indoor air quality. The plan is a National Basic Plan which proposes coordination methods between ministries that prepare detailed measures for indoor pollutant and management facilities, and that supervise and manage these pollutants. The plan requires an analysis of the state of indoor air quality management and related issues to be conducted every five years, in order to guide future policy directions. Currently, the 4th Basic Plan for Indoor Air Quality Management (2020 to 2025) is being drafted. It aims to set up effective management measures for the presence of VOCs and formaldehyde in various multi-use facilities (including newly built apartments), as well as to reinforce management measures for current issues such as fine particles and radon, for instance by developing educational programs or material labeling programs.

There is a strong interest in apartment residents' health and in apartments' asset value in Korea, which has stimulated the government to legalize strict management criteria for indoor air quality

In addition, in order to provide more practical and holistic control measures, the Construction Standard for Healthy Housing (CSHH) was introduced in 2014 by decree to extend the Housing Act. The CSHH covers:

1) Source controls such as the application of low-pollutant-emitting building materials;
2) Ventilation controls such as the compulsory installation of ventilation systems;
3) Removal controls such as the application of VOC-absorptive building materials.

The CSHH works as follows: the construction project entity (generally a construction company) which plans to build or remodel a new apartment building of more than 500 units must prepare a CSHH self-evaluation report including detailed plans to meet the requirements suggested by the CSHH. The submission of the self-estimation report as well as the report for the confirmation of self-estimation is a crucial process to control the implementation of the CSHH. The construction company should file both reports with a public office at both the design stage and the construction-complete stage. The report for the confirmation of the self-estimation should be made by a construction inspection company and submitted to the public office. All in all, the policy supports effective control of the implementation of the CSHH.

1 Choi, D.H. and Kang, D.H. (2017) Infiltration of Ambient PM2.5 through Building Envelope in Apartment Housing Units in Korea. Aerosol and Air Quality Research 17(2), 598-607.

2 The infiltration factor represents the equilibrium fraction of ambient PM that penetrates indoors and remains suspended in the indoor air.

3 Radon is a radioactive, colorless, odorless, tasteless noble gas.

4 Housing Act, Ministry of Land, Transportation and Maritime Affairs, 2009.

5 Indoor Air Quality Control In Public Use Facilities Act, Ministry of Environment, 2008.

View of the city of Seoul, South Korea

In case respecting the CSHH increases construction expenses (for example by using sorptive[6] building material), the construction company is allowed to pass on these additional costs to the sale price of the apartment (even though that price is regulated by government law).

What is the process to check that the measures are well implemented?

D. H. K.: Based on the CSHH self-evaluation report submitted to a public office at the design stage by the construction company, residential housing units should be inspected at the construction-complete stage prior to occupancy by a construction inspection company, in order to confirm that the detailed plans, suggested by the project entity, have been properly implemented. Both the construction company and the construction inspection company should then write a report to the public office, confirming that the CSHH has been respected.

In addition, a check-up of the ventilation system must be performed by a TAB (testing, adjusting, and balancing) engineering firm chartered by the Society of Air-conditioning, Refrigerating Engineers in Korea (SAREK). All housing units must be tested to check ventilation systems. The detailed check-up procedure is specified for TAB of ventilation systems in a residential building by SAREK.

Building companies have cooperated with ventilation companies and made innovative attempts to address fine particle issues

Have you observed any significant improvement since the implementation of the Construction Standard for Healthy Housing? Has this norm been revised since its implementation in 2014?

D. H. K.: According to the Construction Standard for Healthy Housing (CSHH), building companies and building owners must use building materials that meet the regulatory pollutant emission criteria. However, subsequent surveys on the indoor air quality of newly built apartments have revealed a high rate of nonconformity. The exact reason for this nonconformity is unclear, but a possible cause is airtight construction, which is done in order to reduce a building's energy consumption. As a solution, each local government establishes its own criteria to enforce the use of sorptive building materials. For instance, the city of Seongnam has passed regulation that requires the use of sorptive building materials for over 60% of the indoor wall area. In comparison, the CSHH recommends that only a minimum of 5-10% of the indoor wall be made of sorptive building materials.

6 Sorptive building materials can decrease the concentration of an indoor air pollutant by capturing pollutant particles.

Korea has established an Eco label for the building sector. Does this label take into account indoor air quality issues? If so, how does this label work?

D. H. K.: The Eco Mark and HB (Healthy Building) Mark of Korea have induced the use of low-emission building materials by informing consumers of VOC and formaldehyde emissions from building materials. These eco label systems, however, are not suitable for the management of all building materials distributed in the market. This is because eco labels are only provided in relation to building materials for which their manufacturers have requested certification (on a voluntary basis). The Indoor Air Quality Control Act prohibits the use of building materials that exceed the specified emission criteria for pollutants (formaldehyde and VOCs) in apartments. Current building material restrictions have limitations in managing complex and diverse building materials affected by indoor pollutants as they depend on surveys of samples collected from the market, which are not necessarily representative. Therefore, further reinforcements have been implemented in relation to the management of building materials since 2016 by obliging manufacturers and importers to receive certified emission data from authorized testing agencies before supplying materials to apartment construction companies.

There must be efforts to find a solution which allows appropriate indoor air quality to be maintained while reducing energy consumption. Examples of research topics include the development of energy-saving heat recovery ventilators and air cleaning systems

What have been the most significant and innovative initiatives of the private sector regarding indoor air quality over the last few years?

D. H. K.: Building companies in Korea have developed and applied various housing technologies to meet the demands of residents in relation to indoor air quality. Building companies have cooperated with ventilation companies and made innovative attempts to address the issue of fine particles, such as with the installation of FAC (Fresh-air Air Cleaner) systems with enhanced filtration systems, air shower systems which can remove the dusts from occupants' clothes at the entrance and so on. These methods have never been previously attempted in residential apartments.

In order to respect the pollutant thresholds and legal criteria prescribed by government acts, as well as the demands of residents, building companies engage in active research and development of construction technology. This process is currently being repeated as recent issues relating to indoor air quality – fine particles and radon – have emerged. Building companies are also making various efforts to address issues head on, for example by installing HEPA filters[7] on mechanical ventilation systems (the Housing Act prescribes that a new building with over 100 living units should adopt mechanical ventilation systems or natural ventilation devices capable of maintaining a 0.5 air exchange rate).

Which research topics do you think should be further investigated within the frame of indoor air quality?

D. H. K.: The airtightness in buildings is continuously increasing in order to reduce energy consumption. In such airtight buildings, however, the concentration of pollutants may increase because it is not easy to discharge indoor air pollutants. Therefore, there must be efforts to find a solution which allows appropriate indoor air quality to be maintained while reducing energy consumption. Fresh outdoor intake has been one effective solution put forwards in ventilation textbooks. However, in Korea, where outdoor air is polluted due to fine particles, such solutions might be more difficult to find. Therefore, I believe that we need to conduct more studies on the development of indoor air quality management measures for airtight buildings. Examples of research topics include the development of energy-saving heat recovery ventilators and air cleaning systems. Considering the impact of outdoor-originated pollutants on indoor environments, studies seeking to identify the correlation between building airtightness measures and indoor air quality will be important. In addition, the continuous construction of databases on various indoor pollutants will serve as useful information to effectively manage indoor air quality at all design, construction, and operation stages for buildings.

7 HEPA filters (High Efficiency Particulate Arresting), which means High Efficiency Particulate Catchers, absorb the particles suspended in the air.