

# Current Status of Research Activity for Industrial Ventilation and Future Problem in Japan

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## Abstract

Current status of research activity for industrial ventilation and future problems in Japan are reviewed. At first, the outlines of the investigation and research promoted in the committee activity of the academy in Japan are described. The measures of the Japanese administration about industrial ventilation, especially review of related laws are described. Finally, A research trend, especially a ventilation system and ventilation efficiency in Japan are reviewed.

## 1. Introduction

In Japan, As for the ventilation system especially in the working environment, the regulation is done by the Industrial Safety and Health Law enacted in 1972 until now. That is, the specifications decided based on the technology about 30 years ago are continuously applied as for a current regulations system. Moreover, it is typical regulations of specification. Research and development such as ventilators and the air purifiers concerning industrial ventilation is continuously carried out in Japan. However, the actual sites which practices or verifies the result of the research are strongly limited from a legal viewpoint. That is to say, this situation obstructs the development of the industrial ventilation field in Japan.

The present condition of the industrial ventilation in Japan is reviewed for following theme. Industrial ventilation is defined as the ventilation system, which targets are to remove detrimental substance, contaminant and heat following on production activity from workspace.

- (1) The actual condition of industrial ventilation design of Japan
- (2) The measures of the Japanese administration about industrial ventilation, especially review of a related law
- (3) A research trend, especially a ventilation system and ventilation efficiency in Japan

## 2. Governmental Regulations for Industrial Ventilation in Japan

In this section, governmental regulations and standards for industrial ventilation in Japan are outlined. There are several laws and standards, which is related industrial ventilation. Those are shown in Figure 1. Among these, Industrial Safety and Health Law is deeply connected with industrial ventilation.

In the regulations system for working environment in Japan, the concentration measurement in whole working space is made an obligation, and this system differs from the individual exposure management which is main current in Europe and America.

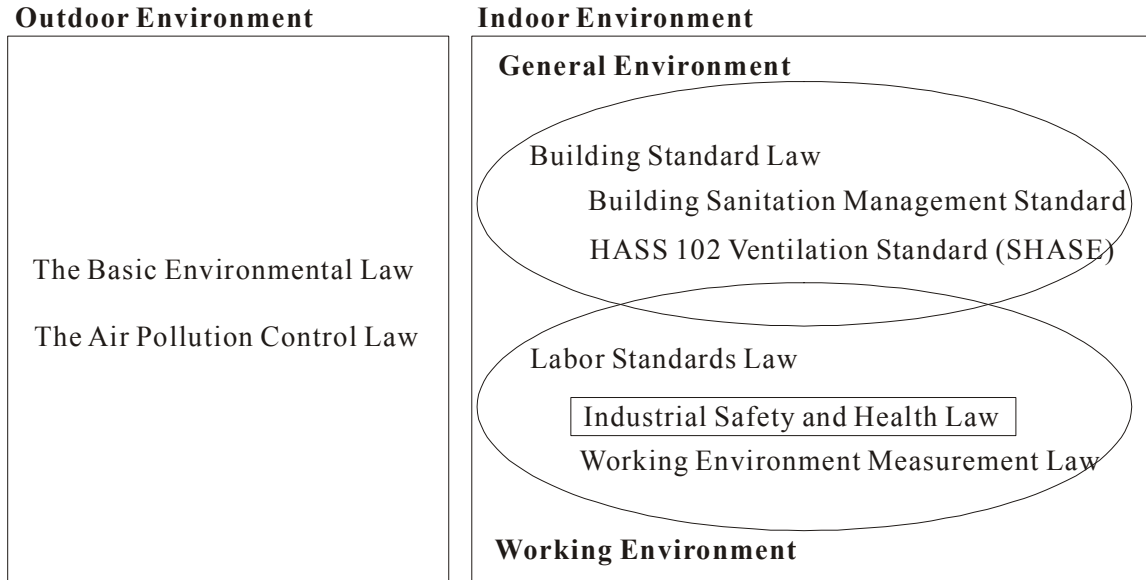


Figure 1 Governmental Regulations and Standards concerning Industrial Ventilation in Japan

### Industrial Safety and Health Law

This law was enacted for the following three purposes.

- (1) Maintenance of health
- (2) Prevention of a healthy obstacle
- (3) Formation of comfortable place-of-work environment

The regulation about ventilation equipment is also mentioned in this law to achieve purposes.

- (1) The notification of an equipment plan (ventilation plan)
- (2) Obligation of installation of a total ventilation and local ventilation devices
- (3) Capability of a hood
- (4) Performance of a duct
- (5) Performance of a fan
- (6) Performance of a air purification equipment
- (7) Performance of a total ventilation system
- (8) Periodical and independent inspection of local ventilation system

These regulations are a little different with a grade of harmful substance such as organic compounds, plumb and suspended particulate materials so on. On the other hand, Japan Society for Occupational Health has given advice the values of acceptable concentration of chemical materials and particles for worker in factory. The acceptable concentration signifies the concentration, which can be considered that the substance does not give harmful effect on almost workers in the space if the concentration of the substance is less than this value, even though they are exposed everyday by this concentration. This means as same as Threshold Limit Values of ACGIH.

In ventilation design of a factory, all engineers follow the regulation of performance of ventilation equipment and design the concentration in a factory seems to become less than

the acceptable concentration recommended by Japan Society for Occupational Health. They design a ventilation system by putting equipment such as canopy, hood, push-pull type ventilation or a dust collector or air purification device together usually.

### **The Basic Environmental Law**

It is the law by which the basic idea about environmental preservation is provided. The Basic Environmental Law defines a desirable standard about the conditions on the environment in connection with air pollution.

### **Air Pollution Control Law**

Air Pollution Control Law was defined and carried out for the purpose that regulates discharge of the detrimental substance generated in connection with the activity in a factory. This law defines the discharge standard of exhausts from a factory.

### **Building Standard Law**

Building Standard Law has defined the standard about the window or opening for ventilation of a room. This law has the technical standard of natural ventilation equipment and mechanical ventilation equipment.

### **HASS (Heating, Air-Conditioning and Sanitary Standard) 102 Ventilation Standard**

The ventilation standard HASS 102 of The Society of Heating, Air-Conditioning and Sanitary Engineers Japan (SHASE Japan) is only a technical standard about the ventilation in Japan.

This standard is revised in 1997 and applies to the ordinary indoor environment mechanically ventilated such as habitable room, office space, attached spaces to those rooms and the spaces for various facilities. Working space as a factory is not contained to application object, but the concept to keep good condition of indoor air quality by ventilation and the technical process of HASS102 must have applicability to working spaces.

This paper focuses on the framework of the standard, design criteria for acceptable concentration of indoor air pollutants, calculation method for ventilation requirement, technical principles for construction of ventilation equipment. Main points for HASS 102 are as follows;

- (1) The amount of ventilation requirement is obtained by the emission rate and the design criteria for acceptable concentration of indoor air pollutants. In other words, the amount of ventilation requirement is calculated in consideration of the situation of space usage and the conditions of air pollutant generation.
- (2) The kinds of indoor air pollutant prescribed for in this standard are CO<sub>2</sub>, CO, suspended particulate, NO<sub>2</sub>, SO<sub>2</sub>, HCHO, radon, asbestos and TVOC. (Table 1)
- (3) Design criteria for acceptable concentration of CO<sub>2</sub> is provided by a general indoor quality index (1000 ppm) as well as one of pollutants influencing occupant's health (3500 ppm). It describes how to properly use these two indexes for each pollutant source.
- (4) When pollutants are not perfectly mixed with the room air, ventilation effectiveness is taken into account for calculation of the amount of ventilation requirement.
- (5) Also prescribed are technical principles for construction of ventilation equipment and test methods of ventilation performance after the construction.

### **3. Committee Activity at Academy**

The investigation and the research on industrial ventilation are carried out under various committees in Japan. The main activities of committees are described as follows.

#### **Activity of SHASE Japan (Society of Heating, Air-Conditioning, and Sanitary Engineers of Japan)**

In SHASE Japan, Committee of Ventilation Design Method and Committee of Industrial Ventilation are existed and acting from 1990 and 2000 respectively.

Committee of Ventilation Design Method targets ventilation design in a general environment and the investigations of the latest overseas trend and the research activity to make standard are done. The main results of this committee are as follows.

##### **(1) Constitution of HASS 102 Ventilation Standard**

As already described in Chapter 2, HASS 102 Ventilation Standard was designed and revised by Committee of Ventilation Design Method.

##### **(2) Constitution of HASS 115 Measurement Method for Ventilation Efficiency in Occupied Zone**

In HASS 102 Ventilation Standard, when pollutants are not perfectly mixed with the room air, the ventilation design using the concept of ventilation efficiency, e.g. normalized concentration in an occupied zone 'Cn', is recommended. In order to evaluate and measure the Cn value, HASS 115 was designed at 2002.

Committee of Industrial Ventilation targets ventilation design of working environment and the investigations of the latest overseas trend concerning industrial ventilation. The committee has made the survey of actual environmental condition in some industrial facilities and also investigated ventilation system of commercial kitchen, push-pull type ventilation equipment. The committee also makes a strong effort to build a network between researchers or engineers for exchanging technical information.

#### **Activity of Other Academic Societies**

In addition to SHASE, there are several academic societies which are intended to achieve a good environment for workers, in Japan. These are Society of Industrial Health of Japan, Japan Industrial Safety and Health Association, Japan Association for Working Environment Measurement and so on. The activities of these societies are mainly to inspect the ventilation equipments installed and to conduct surveillance for keeping a good environment by measurements of air quality and temperature in spaces. That is, management of industrial safety and health, improvement measures against chemical substances and promotion of making agreeable workplace.

### **4. Problems in the Future**

The first problem which should be discussed for improvement of environment in industrial facility is that Industrial Safety and Health Law is still typical regulations of specification. Research and development of industrial ventilation and ventilation equipment has been continuously carried out and many technical results have been accumulated. However, the engineer cannot sufficiently take advantage of the research results into the design or

planning of actual facility because the regulation is specification and the law is not revised for a long time. This situation obstructs the development of the industrial ventilation field in Japan. Industrial Safety and Health Law should be revised to performance regulation which can permit to apply new research results rapidly. Namely, Industrial Safety and Health Law should be revised to permit whatever method can be applied as long as it can maintain good air quality and it has reliable performance.

Secondly, engineers who belong to a different academic society do not share the new information and the new concept of ventilation with them. They are making advances in their studies separately. Therefore, even if the new research result or a solution of ventilation difficulty is proposed in his academic society, the situation has arisen that the research results cannot be use in the actual design of industrial ventilation. It is important to consider all the various factors together in designing ventilation system. It is necessary to make intimate network, with which engineers can exchange their technical information among them, not only in Japan, but with all over the world.

## **5. Concluding Remarks**

The present situation of the activities for industrial ventilation in Japan was reviewed. And it was mentioned what should be done for the future to improve working environment. We have concluded two points as follows:

- (1) Industrial Safety and Health Law should be revised to permit whatever method can be applied as long as it can maintain good air quality and it has reliable performance.
- (2) It is necessary to make a network for exchanging the technical information among researchers and engineers who belong to a different academic society.

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