

Our Programs for Zero-Accident and Zero-Disaster Operations

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Keywords Zero-occupational accident, Safety hands-on experience training car, Safety hands-on training program, VR, Safety Training Center

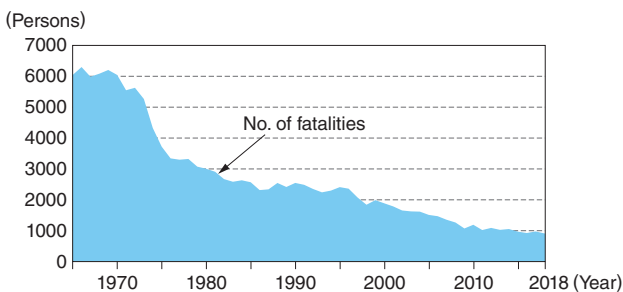
Abstract

Currently, the number of fatalities from occupational accidents in Japanese industry is decreasing year yearly. Though good news, the rate is not zero, so precious lives are still being lost. The number of injuries requiring more than four days of temporary absence from work has slightly increased since 2010. There are various possible factors for this, but this shows that activities related to occupational safety are not as effective as they should be. Our occupational safety rate is not exempt. We take this situation very seriously. In order to achieve the long-cherished desire of “zero-accident and zero-disaster operations” or “zero occupational accidents”, we are working on our mission to eradicate occupational accidents with various approaches, such as an “analysis of the occurrence of occupational accidents based on data”, “implementation of on-site safety experience education”, and “opening of a Safety Promotion Center that clearly exhibits facts of past occupational accidents to visitors”.

1 Preface

Japan’s industry entered a period of high economic growth in the 1960s, but as a result of disregarding conditions because it emphasized productivity, the number of fatalities due to occupational accidents exceeded 6000 every year, and the harsh working conditions became a social concern. At that time, there were no guidelines for workers to work safely and comfortably, and they had to wait

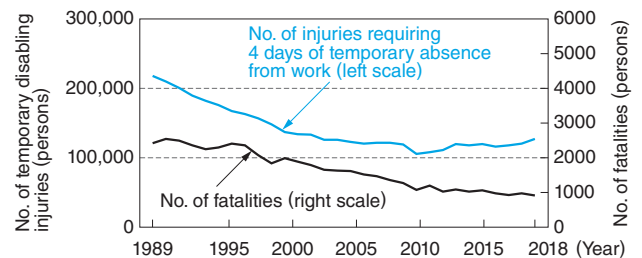
for the Industrial Safety and Health Act to come into effect in 1972. **Fig. 1** shows changes in the number of fatalities due to occupational accidents, and **Fig. 2** shows changes in occupational accidents. The number of occupational accidents has decreased due to the revisions to the Industrial Safety and Health Act and improvements in equipment, but it has increased slightly since 2010. This paper introduces our efforts for zero-accident and zero-disaster operations.



Note: Excerpt from “Long-term labor statistics expressed in graphs” by The Japan Institute for Labour Policy and Training (JILPT) and training established on the basis of “Labor disaster occurrence status” by Ministry of Health, Labour and Welfare of Japan

Fig. 1 Changes in the Number of Fatalities Due to Occupational Accidents

For numerical values in 2011, numbers directly relating to the Great East Japan Earthquake are excluded. The number of casualties directly caused by the Great East Japan Earthquake was 2827 and the number of fatalities was 1314.



Note: Excerpt from “long-term labor statistics expressed in graphs” by The Japan Institute for Labor Policy and Training (JILPT) established on the basis of “Labor Disaster Occurrence Status” by Ministry of Health, Labor and Welfare

Fig. 2 Changes in Occupational Accidents

The number of fatalities is decreasing yearly while the number of injuries requiring more than four days of temporary absence from work has slightly increased.

2 Our Occupational Accident Analysis

Fig. 3 shows the transition of occupational accidents at our company. In regard to our situation, occupational accidents with and without temporary absence from work occurred in 34 cases including two cases of fatal accidents in 2013. Taking this worst situation seriously, the Occupational Health and Safety Management Division was established as a division that manages safety and health across the entire company. Due to various efforts, the number of occupational accidents is only moderately decreasing yearly.

Fig. 4 shows the type classification of occupational accidents at our company (Fiscal 2014 to 2019)

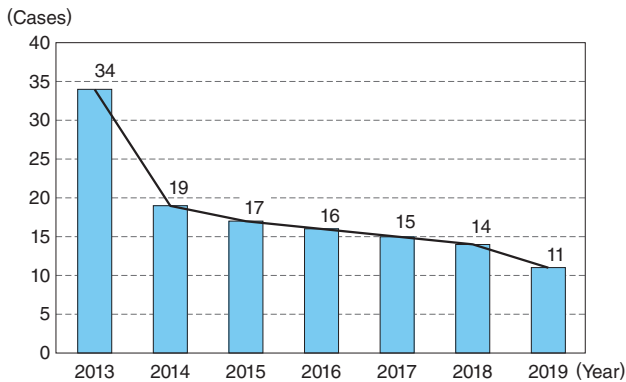


Fig. 3 Transition of Occupational Accidents at Our Company

As a result of various remedial activities, labor accidents are decreasing year after year.

2019), and **Fig. 5** shows the type classification of the recent occupational accidents at our company (Fiscal 2018 to 2019). Although there have been many accidents caught in the past, the number of accidents caused by falls has increased recently, and drastic improvement measures are urgently needed.

Fig. 6 shows the age classification of occupational accidents at our company (Fiscal 2014 to 2019). The current status reflects that there are many people in their 40s, but it is probable that although they were familiar with the work, they were overconfident and did not notice a decline in their physical strength.

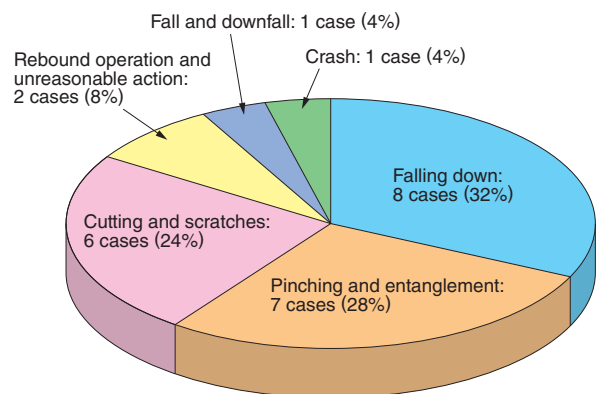


Fig. 5 Type Classification of Recent Occupational Accidents at Our Company (Fiscal 2018 to 2019)

Occupational accidents by "falling" are remarkably increasing.

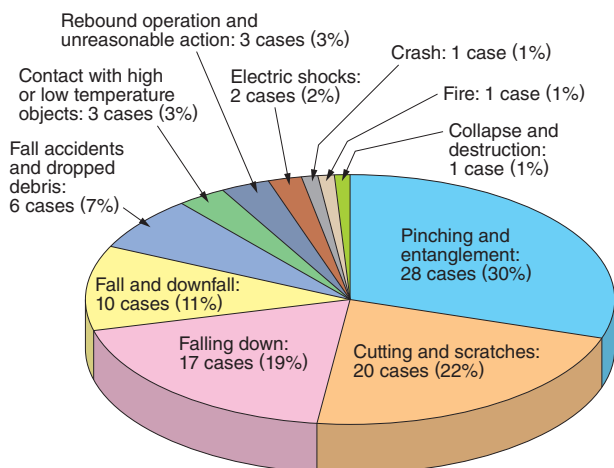


Fig. 4 Type Classification of Occupational Accidents at Our Company (Fiscal 2014 to 2019)

Regarding accidents caused by pinching and entanglement, frequency of occurrence was high. The frequency level follows in the order of cutting, scratches, and falling down.

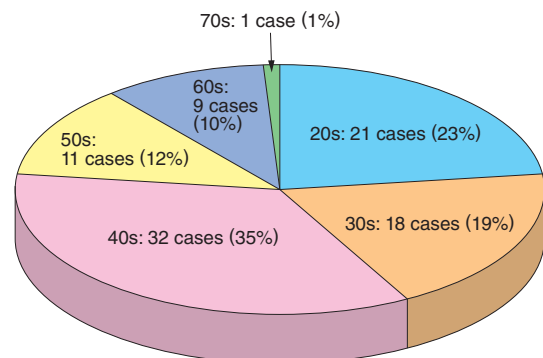


Fig. 6 Age Classification of Occupational Accidents at Our Company (Fiscal 2014 to 2019)

Labor accidents of ages 40s and 20s are prominent. Reasons are considered to be that persons of 40s have thorough knowledge of jobs but their physical strength decreases and those of 20s have enough physical strength but are not as accustomed to their jobs.

3 Our Occupational Health & Safety Efforts

In view of this situation, we are working on occupational health and safety with various approaches.

3.1 Promotion of on-Site Safety Hands-on Training Programs

The safety hands-on experience training program has been implemented since 2009, and in 2017, it became more actively operational with the completion of the first safety hands-on experience truck. Our safety hands-on experience training program is not a classroom-based course that is often found in conventional safety promotion program, but an education in which students actually can see, touch, and feel something through safety promotion devices and experience a safe-level danger physically to increase their sensitivity to danger. We have “real experience devices” that mimic an accident and give the realistic sense of danger. We also have a “Virtual Reality (VR) experience device” that offers a virtual experience of a reproduced accident that is difficult to replicate in reality. We have been providing the safety training programs using these two types of devices. **Table 1** shows a list of real safety experience devices owned by our company, and **Fig. 7** shows an example of a stepladder wobble experience device.

Although traditional hands-on education is effective, it has not been easy for employees working in the field to leave the project sites for training programs in terms of time and distance. The safety hands-on experience training truck was developed to solve this problem. It can be equipped with safety

experience equipment on a loading platform of trucks or trailers, and it can instruct people at various sites all over Japan.

We have been providing instruction at many of our construction project sites. In addition, it is necessary to constantly provide new content in order to prevent the instruction inside and outside of the company from becoming dull. In order to overcome this, in 2019, a trailer type education truck was developed and we started operating the second safety hands-on experience training truck. **Fig. 8** shows the external appearance of safety experience trucks: No.1 Car and No.2 Car. The major differences between No.1 Car and No.2 Car are as follows.

- (1) No.1 Car is a truck type, while No.2 Car is a trailer type and can be equipped with more safety experience devices and can be transported overseas as is.
- (2) No.1 Car is an outdoor open type, but No.2 Car is an indoor enclosed type that enables all-weather education with air conditioning.
- (3) No.1 Car specializes in occupational accident scenarios at construction sites, while No.2 Car specializes in occupational accident scenarios at manufacturing sites. Taking advantage of its large volume and indoor type, a VR device is always available. It began to be used in October 2019, and as of February 7, 2020, 1457 employees were taught at our Numazu Works. From now on, it will be used at our Ohta Works, Nagoya, Works and Kofu Works where we plan to provide safety hands-on education programs.

Table 1 List of Real Safety Experience Devices Owned by Our Company

A List of Safety Experience Devices Available in No.2 Car is shown.

| Type of accident | Name of safety experience device |
|---------------------------|---|
| Pinching and entanglement | Apparatus for pinched feeling in the finger at the time of slinger handling Device for feeling pinched by a press machine Device for feeling caught by a chucking machine Device for feeling of entanglement by a bench drilling machine |
| Explosion | Device for feeling of solvent explosion |
| Fire | Device for feeling of a fire |
| Electric shock | Device for feeling cable short-circuiting, over current, electric shock |
| Others | Device for feeling wobbling stepladder |



Fig. 7 Stepladder Wobble Experience Device

Device for feeling wobbling stepladder is shown. A real stepladder is used. This is an example of safety experience device by which danger is felt closely to the body.



(a) No.1 Car



(b) No. 2 Car

Fig. 8 Safety Experience Trucks

External appearances of the safety experience trucks are shown.

3.2 Development of New VR Device

While conducting safety hands-on experience training on safety training vehicles, our customers came to appreciate the need for safety education. In the process, there was a request from a customer that they would like to have safety experience devices by themselves, but even if the customer had some safety experience devices, they might face the challenge of dull and obsolete programs.

For this reason, the training program becoming dull and obsolete can be avoided if a VR device is used, by adding new contents. As such, there were many requests from our customers to introduce this in-house safety training program. The development of VR device-based training program was urgently needed to meet the demands of the market. **Fig. 9** shows a 3-axis simulator. In this simulator, the pedestal of the simulator supported by three axes moves in conjunction with the VR content, and the virtual space that has never existed before and the actual movement of the real world are combined, giving a more realistic experience. It can be said that positive effects of our hands-on safety experience training programs are increasing.



Fig. 9 3-Axis Simulator

Next-generation type of safety hands-on experience training device is shown. A feeling of a realistic presence is enhanced by the base interlocked with the VR contents.



Fig. 10 Safety Promotion Center

This shows an in-house educational facility opened in January 2020.

3.3 Establishment of Safety Promotion Center

Fig. 10 shows the Safety Promotion Center. While the hands-on experience safety training program is a very “active” style of training that moves

the body, the Safety Promotion Center is a “softer” style training program that appeals more to the mind. Immediately after a serious disaster, everyone typically feels strongly that they should not repeat the same mistakes.

It is, however, also true that the memory of such an event will fade from our minds over time. In particular, if the persons involved in occupational accidents are transferred to other business unit, such lapse of memory on occupational accidents that have occurred will increase. Until now, we have not actively looked back on the cases of industrial accidents which are a negative legacy. It is absolutely unacceptable, however, to turn away from the thoughts on such employees and their families after being negatively affected by an occupational accident. The Safety Promotion Center was opened for the purpose of respectfully imparting facts and remorse of such incidents to current and future employees and what we should learn from them. The establishment of the Safety Promotion Center is not the end of our efforts, and we will work on many other company-wide safety initiatives to make this Center a place that appeals to the hearts of the visitors.

3.4 Building Safety Information Management System

Although it is certain that education is effective in terms of safety efforts, it must be based on objective analysis. Until now, we did not collectively manage occupational health and safety data, and instead, stored each incident of his data individually. To remedy this, we built a “safety information man-

agement system” that comprehensively links and manages them. The first system made was a system that can centrally manage the labor damage reports as the data base by inputting each case. The next steps are creating a: ① registry of reports in the system such as close-call (hiyari-hatto) incident report, on-site safety patrol reports, ② the management of traffic accident reports, and ③ making a new system enabling to acquisition of data that can analyze the corporate structure, such as the frequency rate (an index for evaluating the occurrence of occupational accidents), an intensity rate (a formula for calculating the ratio of the amount of loss (lost working days) caused by an occupational accident per 1000 total working hours) and the annual 1000-person rate (the percentage of casualties per 1000 workers per year).

4 Postscript

There are no shortcuts in our efforts to realize zero-accident and zero-disaster operations. All we have to do is to reliably repeat the same thing. Even if we build various safety educational opportunities and safety database systems, in the end, the relationship between people is the most important. In addition, self-awareness is required to increase each person’s risk sensitivity. We will make efforts around the clock to achieve zero-accident and zero-disaster operations.

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