

## WORKER PARTICIPATION TO PREVENT MUSCULOSKELETAL DISORDERS IN THE ASSEMBLY OF BOILERS

### General information

**Country:** Italy

**Sector:** Manufacturing

**Type of organisation:** Manufacturer of wall-mounted boilers

**Size of organisation:** 150 employees (involved 31 assembly workers)

**Location:** Industrial area

**Job/tasks:** Manual assembly work

**Workplace and task characteristics:** Repetitive movements, pushing the boilers, lifting (mainly with the forklift), standing workplaces, awkward postures.

**Workplace participation measures:** The main worker participation measure was worker focus groups and fault tree analysis using a participatory approach to identify and prioritise hazards, as well as to assess and develop solutions.

### The action

#### Background

##### *Project start*

Researchers introduced the project to the company to identify the causes of workplace hazards and to minimise occupational accidents and injuries. The project used an innovative participatory technique combining two methods: focus groups with workers (FGWs) and the fault tree analysis (FTA) method.

The aim was to identify leading indicators in determining critical factors that can cause occupational injuries and disorders. The researchers and representatives from the company started with an analysis of the root causes of accidents based on a public database managed by the Occupational Insurance Agency. The researchers developed a method that included getting workers to participate in identifying and prioritising occupational hazards, as well as developing solutions. The method focused on the factors that led to safe behaviour.

The main participatory approach was focus group discussions (workshops) with workers based on the FTA results. The focus groups' goals were to examine the consequences and causes of unsafe behaviour that may result in work-related musculoskeletal disorders (MSDs).

A major work task was assembling a wall boiler. Heavy and large items needed to be manipulated several times. The workers reported being tired at the end of working shifts. This tiredness meant they required more effort to do things, so they adopted more awkward postures. At the same time, the company claimed it had a proper and adequate work organisation and work cycle.

#### Fostering a culture of prevention

The company expressed that their workers were its most important resource. However, the project revealed the company did not have a strong prevention and participatory culture that involved workers in occupational safety and health (OSH) issues. After the project, the company used worker participation approaches to investigate other occupational hazards and improve working conditions. Meanwhile, the company made investments to demonstrate its commitment to improving safety and health, particularly regarding the assembly lines, equipment, plants and training programmes for all personnel. As part of establishing a prevention culture, the company required workers to comply with safety regulations to ensure safe behaviour according to company standards.

## Participants and stakeholders

In total, 31 assembly workers participated in the project. The assembly activity took place at different workstations, and included packing the assembled boilers. The workers rotated between the workstations during their shifts.

The researchers (safety professionals) designed the intervention by using a method that combined FGWs and FTA. The researchers had developed this method a few years earlier after several discussions with focus groups in different industries (manufacturing, food processing and construction). The researchers participated during the entire intervention. They first met the management (CEO, production manager, safety manager), the safety representatives and the trade union representatives to prepare for the intervention. During the intervention process, the safety professionals acted as moderators. To perform their analysis, the researchers divided the workers into three groups: two experimental groups and one control group.

## Participatory approaches, methods and tools

The participatory approach consisted of focus group discussions with workers that analysed risks and their causal factors (contributing causes) using FTA and FGWs. The aim of the FGWs was to facilitate discussions and gain knowledge about problematic areas in health and safety in workplaces. The purpose of the FTA was to guide the discussion with the workers who participated in the FGWs. For a particular risk, a fault tree is created that is broken down into subsidiary and basic casual factors. In this case, a work activity (boiler assembly) was broken down first into the various risk factors, which were each broken down into their consequences, and further broken down into the causal factors. When this was done, the preventive measures to tackle the casual factors and individual improvement measures needed to achieve each preventive measure could then be mapped out. The FTA provides a structure, but also offers the participants an easily understandable visual overview of all the risks and their causes that are associated with a particular task.

The intervention was divided into the four steps described below.

### Step 0: Launch the project activity

The aim of Step 0 was to understand the organisation, get acquainted with safety personnel and safety procedures in the company, and explain the methodology. Two meetings were organised where two safety professionals met the relevant stakeholders from management (CEO, production manager, safety manager), the workers' safety representative and the trade union representative. Two additional meetings were used to study the job activities performed by the assembly workers and to form three worker groups: 2 experimental groups consisting of 12 workers each and a control group with 7 workers.

### Step 1: Identify occupational hazards and worker perceptions of safety and health bottlenecks

Step 1 specified the activities performed by the workers and identified safety issues and risky work situations in the assembly line. Before the start, all participants filled in a questionnaire with 32 safety-related questions examining the assembly activities performed by the workers and the related risks prepared by the moderators and safety manager. The two intervention groups then participated in the first FGW moderated by the safety professionals. The moderator facilitated the discussion between the workers on details in the assembly activities and the related risks. The two groups identified 15 different risk factors during the assembly work shift. These included the ergonomics of the workstation, manual handling and repetitive movements. The control group did not participate.

Following this, all the participants completed a second questionnaire rating the effectiveness of the control measures for each risk.

### Step 2: Identify consequences, causes and improvement measures

Step 2 covered a detailed examination of the issues identified in Step 1 to identify the consequences and causes of these risks and provide a complete overview of preventive measures to control them. Both intervention groups participated in a 90-minute focus group attended by the safety representatives. Using FTA, the workers' discussion helped to identify the potential consequences and causes of each selected risk factor. The moderators also invited participants to analyse the prevention measures used in the workplaces. Finally, the workers proposed possible improvement measures for the risk factors' identified causes. The control group was not involved in Step 2.

## Step 3: Assess occupational hazards and worker perceptions of safety and health bottlenecks

Step 3 assessed the project's effect on workers' knowledge about OSH in their workplaces. Two focus groups were conducted. Moderators promoted a discussion on the results of the procedure in Step 2. Workers from all three groups completed a second questionnaire that examined the workers' perceptions of the proposed safety measures for risks identified during the project. For each identified risk, the workers provided their perceptions of severity and probability (scale from 1 to 10) and their opinion on the adequacy of the proposed safety measures. This step was part of the research project to assess the effectiveness of the FGW-FTA methodology. The workers involved in the focus groups showed an increase in knowledge and awareness of occupational risks compared to the control group at the end of the project.

### What was achieved

Workers were involved in OSH activities through discussions and analyses of possible causes of health problems and accidents. In addition, they felt a high level of commitment and sense of involvement in developing better solutions. Although the external safety professionals (experts) were involved in the focus group discussions, workers felt quite comfortable in expressing their opinions, perceptions and ideas.

The result was an increased awareness among the workers about the importance of communicating and commenting to the management about any working condition that was a potential long- or short-term risk to workers, equipment or plant.

Workers' readiness and awareness were evaluated before and after the intervention. Workers' improved their knowledge and awareness of risk management (related to the manual assembly of the metal boilers), safety knowledge exchange, teamwork and cooperation. The awareness focussed on MSD prevention by applying specific work procedures and postures, and following instructions for the use of equipment and tools.

The workers' assessment revealed the weaknesses of the existing safety preventive measures and proposed a set of effective and easy-to-apply improvement safety measures and corrective actions.

### Participatory approach

The focus group workshops were the main participatory element. They involved workers in the analysis of consequences and causes of unsafe behaviour that may result in MSDs, accidents, or near misses. An important point was information about the project's innovative content and workers' leading role in identifying the risks and control measures of their own work. Additionally, during the focus groups, workers' participation in constructive discussions was stressed. These actions ensured workers' active participation in the workshops.

Because of the positive results, the company's management kept this approach to OSH and continues to apply it on its own. When the workers experience the responsibility for their actions and feel that their suggestions reach top management, they are motivated to contribute to their own safety and health, and to the safety of the whole organisation.

### Solutions and improvements

Workers identified problems in the production line and proposed several improvements in the boiler assembly to control risks related to the falling of the boiler, cutting and slipping, as well as those related to ergonomics. For example, to minimise extensive push force in the assembly line, workers suggested replacing manual hooks with electric ones and increasing maintenance activities. Thanks to the workers' observations, the company was able to design and develop effective solutions for the assembly line process.

### Worker satisfaction with the improvements

Workers expressed overall satisfaction with their contribution to improving the work environment. The workers reacted positively when the management followed up on their suggestions. For example, the interventions targeted work equipment, workstation layout, and also some modifications of the product assembly steps to ease component assembly.

## Case extracts

*'The workers were positively hit by the interventions implemented by the management following their suggestions and recommendations for improving the work environment'.*

The result was an increased awareness among the workers about the importance of communicating and commenting to the management about any working condition that was a potential long- or short-term risk to workers, equipment or plant.

Based on the inspection of job activities and review of safety documents, safety professionals prepared workshops, and stimulated and moderated discussions on workplace hazards.

The workers were informed about the innovative content of the project in the context of OSH training programmes and about their leading role in identifying the risks of their work and proposing risk control measures. Additionally, they were informed about the importance of their active participation during the focus groups, expressing the importance of everyone's contribution in developing a constructive discussion. These actions ensured workers' active participation in the workshops and discussions.

## Resources, costs and benefits

- The National Institute for Insurance against Accidents at Work (INAIL) provided a grant for the project and the company management provided additional resources. INAIL's assistance was part of a programme for support from experts or researchers to companies.
- The main intervention costs related to planning and organising the workshops, for example preparation, refreshments, stationery and work time was financed by the company. In addition, there were the costs for implementing changes. The cost for the focus groups was comparable to traditional safety training programmes. Two safety professionals (experts) were involved in each workshop to stimulate and moderate the discussion and to analyse the root causes of workplace hazards based on the FTA. However, as mentioned, INAIL provided support for this. Furthermore, the cost-benefit balance for this activity was completely in favour of the benefits.
- The benefits of the approach adopted in the company included improved support from the workers to implement effective risk control measures, increased cooperation and teamwork, as well as an improved safety culture and involvement of workers in company health and safety activities.

## Analysis

### Barriers

- The support from a researcher or expert was important to begin the process, support workers in becoming familiar with the methodology and guide the whole process. It required additional costs for work time and improvement. Therefore, the methodology may not be feasible for micro and small enterprises.
- The intervention process was relatively long (might take several months), and required dedication and time from both management and workers.

### Facilitators

- The process of identifying risk factors was a core part of the intervention. The more relevant the identified risk factors were, the higher the learning process for the workers, and the more efficient and relevant the solutions and safety measures.
- The proposed methodology was based on the active involvement of the workers and on their ability to learn from their direct experience. Moderators' skills to facilitate the active participation and discussions was crucial to the successful intervention.

### Innovative feature

The novel feature consisted of a participatory technique that combined two methods: FGWs and the FTA that helped to get beyond surface impressions.

### Lessons learned

- For the successful implementation of this focus group approach, a strong commitment by management was required.

- Two meetings were necessary to provide the company with a proper description of the FGW-FTA methodology and to retrieve the relevant safety documentation, such as risk assessment, adopted preventive and protective measures, and the register of injuries and near misses.
- In addition, two inspections were necessary for the safety professionals (experts) to observe the assembly workers' job activities.
- The workers' involvement in the discussion and analysis increased their operational awareness of risk management and improved organisational information dissemination among workers, employers and all the safety professionals within and outside the company.
- Workshops organised during working hours can not only improve workers' participation and their involvement in identifying the occupational hazards and weaknesses in existing safety measures, but can also increase their commitment to safety, improve their safe behaviour and produce better solutions.

## Transferability

The participatory intervention is directly transferable to other manufacturing companies in other sectors and countries. It is better suited to larger and medium-sized companies instead of small ones. The researchers have successfully tested the same methodology in a waste management company and are planning new studies to develop the methodology further. However, with a trained facilitator, the basic approach to mapping out risks and their causes could be applied to organisations of any size.

## References and further information

Mosconi, S., Melloni, R., Oliva, M., & Botti, L. (2019). Participative ergonomics for the improvement of occupational health and safety in industry: A focus group-based approach. *Proceedings of the Summer School Francesco Turco*, 1, 437-443. Retrieved 15 July 2021, from: <http://www.summerschool-aidi.it/edition-2019/cms/extra/papers/581.pdf>

For this case study, the publication was supplemented with two semi-structured interviews with a researcher and the company's safety manager.