

REDUCING ACCIDENT RATE DUE TO ERGONOMIC HAZARDS IN THE CHEMICAL INDUSTRY

1. Case metadata

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39881B	Materials handling hazards
44161C	Pallets
52121C	Musculoskeletal disorders
54281D	Ageing workers
57521C	Chemical plants

2. Organisations involved

Clariant Ibérica Producción S. A.

3. Description of the case

3.1. Introduction

Clariant is a global leader in the field of specialty chemicals, represented on five continents with over 100 group companies. The company, headquartered in Switzerland, employed around 20,000 workers, generating sales of CHF 8.1 billion in 2008. Clariant's businesses are organized in four divisions: Textile, Leather & Paper Chemicals, Pigments & Additives, Masterbatches and Functional Chemicals. Committed to sustainable growth springing from its own innovative strength, Clariant got globally certified with ISO 9001, ISO 14001 and OHSAS 18001.

The Clariant Group has four production plants in Spain, located in El Prat de Llobregat, Sant Andreu de la Barca, Castellbisbal and Tarragona. The Clariant factory located in El Prat de Llobregat is the major productive plant in Spain. The case study focusses on this plant. El Prat factory with more than 35 years of history is one of the most technological advanced factories of the Clariant Group. It produces dyes for textile, leather and paper (azoics and anthraquinonics), auxiliary chemical

products, pigments and pigments preparations. There is a huge flow of raw materials into the various Clariant factories and tonnes of filtered products are transferred within the company.

In the production line of El Prat there were points where human intervention on the spot and manual feeding/unloading was necessary. The study of the accident rate at the production site El Prat showed that almost half of the accidents were of ergonomic origin. A detailed analysis of the high risk work activities revealed places that needed intervention (see table 1).

Table 1: Job specific activities involving ergonomic hazards

Work activity	Causality rate
Loading of sacks into a vessel	22%
Loading of drums into a vessel	17%
Loading of ice carts into a vessel	4%
Unloading of press filters	4%

Source: Clariant Ibérica Producción, S.A, 2009

3.2. *Aims*

The company wanted to provide a safer and healthier workplace. An improvement of working conditions was supposed to diminish accident rate and related costs. As the analysis of accidents showed remarkable ergonomic risks, the main emphasis was on the tackling of these adverse work conditions. But the comprehensive risk assessment of the workstations and processes revealed additional risks that also needed intervention.

3.3. *What was done, and how?*

The company's prevention service carried out an ergonomic analysis of work activities. They proposed solutions for each workplace, and these proposals were evaluated in order to find the best fit method.

For the assessment the OSH specialists used the NIOSH/OWAS methods which includes video recording of work activities and the use of dynamometers to measure forces. The original and new methods were recorded. For the analysis a computer programme was used to present comparable results in order to choose optimum solutions for the work activity in question. The production line was inspected according to the above mentioned methods.

The team leading this project was from the Environment, Safety and Health Affairs (ESHA) Department from the Production Site El Prat, following the guidelines of Corporate ESHA Department, with the aim of fostering and sharing the know-how and best practices throughout the whole Group.

The high risk work activities and methodology used are described in more detail below.

Loading of sacks into vessel

Raw materials for the chemical synthesis come from suppliers in different containers, mostly in sacks (see figure 1). During the analysis different ways of manual handling of these sacks, different types of sack materials (plastic, paper, textile) were compared. The assessment also included the effects of the placing of sacks on the pallets and the height thereof. The following measures were introduced to reduce ergonomic hazards:

CASE STUDIES

- Engineers developed a funnel for the vessel intake. This has elevated the working height to a more comfortable 70 cm (see figure 2).
- The company issued work instruction showing the right way to carry out manual load handling in general and manual handling of sacks in particular.
- A working group consisting of employees from the purchase, the production and the prevention service departments was set up. The aim of the group was to manage contact with suppliers to minimise the purchase of raw materials in sacks, thus prioritizing the purchases in 'Big-bags'.
- The company organised training for workers on correct manual load handling techniques.
- In the warehouse area they installed a TROMPEX vacuum lifting system for sacks/jerricans to prepare "peaks" of raw materials for production during palletisation.

Figure 1. Loading of sacks before the intervention



Source: Clariant Ibérica Producción, S.A., 2009

Figure 2. Loading of sacks after intervention: more ergonomic workflow



Source: Clariant Ibérica Producción, S.A., 2009

Loading of drums into vessel

In the chemical industry, raw materials are delivered in various types of containers, such as sacks, drums, etc.. The aforementioned examination of the workflow (video, dynamometry) revealed high risk work elements when handling the drums. The highest risks were related to the controlling of drums manually when pushing them for unloading into the mouth of the vessel, using inappropriate techniques for loading drums into the vessel and using manual load handling at the drums palletising stage.

The following measures were introduced to reduce the ergonomic hazards:

- A funnel was developed for the vessel intake. This directed the drums, thus easing control and also prevents falling of drums or workers into the vessel.
- Drums were replaced by big-bags (that are handled by forklifts) thus eliminating manual handling.
- Staff was trained on the use of the Gator Grip Drum Grab to transfer/place the drums onto the pallets.
- Raw material DCBC is a category 2 carcinogenic substance. The engineering department with an external consultant developed a completely automated and sealed unloading process (see figure 3).

Figure 3. Automatic intake workstation with lift



Source: Clariant Ibérica Producción, S.A., 2009

Loading of ice into vessel

The El Prat plant makes its own ice. Ice is used to control the temperature of the different chemicals syntheses carried out. Workers removed the ice from the unloading silo using carts which, after being transferred with forklift trucks, must have been manually handled at the mouth of the vessel and emptied with the aid of plastic spades. These types of carts were also used to put common salt into the synthesis vessels to precipitate products for subsequent filtering. The assessment showed that manual transfer and unloading of carts was a heavy task. A cart loaded with salt can be 1150 kg. The above detailed methodology was used to assess the task of transferring and loading the ice into the vessel (see table 2).

Table 2. Different loading/transferring methods evaluated

Unmodified cart / unloading using a forklift truck - rejected
Modified cart / unloading using a forklift truck - rejected
Modified cart / unloading using a pneumatic vibrator – accepted with further modifications

Source: Clariant Ibérica, 2009

CASE STUDIES

The following measures were introduced to reduce the ergonomic hazards:

- the capacity of the carts was augmented;
- carts were modified to have easy access to the vessel and enable machine dragging;
- the initially used pneumatic vibrator was revised by the supplier to enhance efficiency;
- the company launched a project to carry ice in big-bags;
- noise from the vibrators was attenuated by an engineering intervention with silent blocks.

Unloading filters

Filter systems are used to get the dyes and pigments from the solvent. These huge filters used to be unloaded and cleaned manually (see figure 4). The above detailed assessment and analysis of work showed overload, unfavourable ergonomic conditions, risk of loss of balance, and consequent falls.

The following measures were introduced to reduce the ergonomic hazards:

- the handle of the spades were elongated to provide access to distant parts of the filter without the need of bending or leaning (see figure 5);
- high pressure water is used for cleaning the channels;
- an automatic cleaner system using water jet was introduced for certain filters.

Figure 4. Manual cleaning of filter with the old spade.



Source: Clariant Ibérica Producción, S.A, 2009

Figure 5. Modified spade with long handle tackles awkward positions



Source: Clariant Ibérica Producción, S.A, 2009

Use of big-bags

The company did not stop after the first risk assessment process, and reassessed the modified working conditions. Risk of the use of big-bags was needed to be assessed, and the continuous adaptation of the system was continued. Handling big-bags with the forklifts originally necessitated many getting on and offs. It could reach 240 on and offs in a single 8 hours shift, increasing accident risk. The big-bag-pallet-forklift interface was modified and the number of necessary getting on and offs was quartered.

The following measures were introduced to reduce the ergonomic hazards:

- the company developed a document on proper ways of handling loads, including sacks, drums, big-bags, and also on strengthening exercises for workers;
- bad practices in getting on and off forklift trucks were identified in the analysis of video recordings. These findings were used for the development of the training on proper work techniques;
- the forklifts should be used to adjust work height thus reduce the need for lifting, and for the handling of drums with the GATOR grip drum grab. The company integrated instructions on good practice of filter unloading, getting on and off forklifts into the safety training of workers;
- the company installed a vacuum lifting system into the warehouse area where they pile sacks on the pallets, and one for the production area as well (see figure 6).

CASE STUDIES

The effectiveness of the intervention measures were verified through 'Job Observations' by management with workers participating as observers. The prevention service developed guidelines describing the procedure for carrying out and documenting Job Observations.

Figure 6. Vacuum lifting system in operation



Source: Clariant Ibérica Producción, S.A., 2009

Costs

The costs of the various measures were:

- Addition of a funnel: EUR 600.
- Purchase of a vacuum lifting system: EUR 9,000.

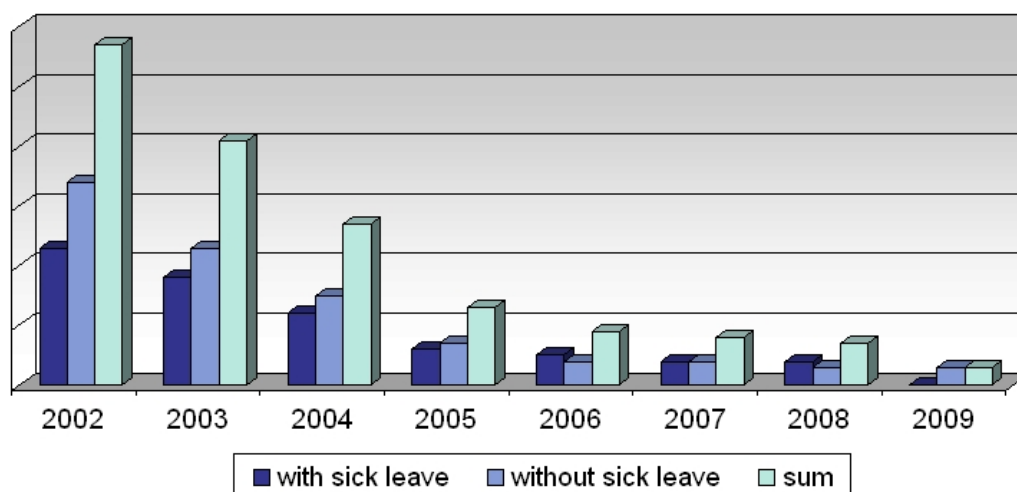
- A GATOR grip drum grab: EUR 600.
- Development of the big-bag system: EUR 3,000.
- Development of the sealed unloading system of drums containing chemical substance DCBC: EUR 700,000.
- Modifying ice/salt cart structure and adding vibrators: EUR 1,500 each.
- Automatic water jet filter cleaning system: EUR 70,000.
- New forklift-pallet-big-bag interface: EUR 600.

3.4. What was achieved?

The overall balance of the project was successful in safety, social and financial terms:

- there was a well seen reduction in excess workload and the accident rate (see figure 1);
- ageing workers could be kept in work, because jobs became physically less demanding;
- staff turnover decreased - especially for tasks which were considered physically demanding;
- productivity increased as many tasks could be carried out by one worker instead of two;
- exposition to carcinogenic chemical substance DCBC almost eliminated;
- DCBC substance management turned more environment friendly;
- ice loss during transfer diminished (Gain of 150 tonnes a year);
- the fleet of manual unloading ice carts reduced (10 instead of 30);
- maintenance costs decreased due to the reduced number of carts in use;
- disposing of superfluous old carts created free space.

Figure 7. Accident rate statistics at plant 'El Prat'



Source: Clariant Ibérica Producción, S.A., 2009

3.5. Success factors

The company used a proven assessment system. Every detail was taken into consideration and all possible solutions were assessed. The workplace interventions were effective, efficient and carried out immediately. Intervention measures have enhanced productivity and reduced accident related costs and therefore the investment is convincing for financial reasons too. Continuous improvement and monitoring of the system provides maximum efficiency and sustainable result in the future.

The company:

- improved the working conditions of those tasks with the highest number of work-related accidents by carrying out a rigorous risk assessment.
- managed to reduce and/or eliminate risk at source by introducing new equipment and/or modifying processes and installations.
- elaborated working procedures in order to improve the working postures and reduce musculoskeletal disorders.
- set up a working group with people from different departments (purchase, production, prevention service) and workers to tackle the problems and stimulating the participation of workers.
- achieved change in attitude of integrating prevention in every worker's activities.
- these results were realised with the cooperation of the upper management, managers and workers, and the technical advice from the Company Prevention Service (ESHA).

3.6. Further information

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3.7. Transferability

The NIOSH/OWAS methods are available but their applications need expertise. The thorough and careful approach during investigation is a factor that should be transferred in cases of workplace interventions. The obvious results of better ergonomics can be adapted at any company where manual handling of loads and awkward postures poses high risk to workers.

4. References, resources:

Information provided by the company in the framework of the Good Practice Award Competition 2008/2009.