CASE STUDIES

ENSURING OCCUPATIONAL SAFETY AND HEALTH

1. Case metadata

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2. Organisations involved

Sauer Danfoss a.s.

3. Description of the case

3.1. Introduction

Sauer-Danfoss is one of the world's largest manufacturers and suppliers of mobile hydraulics, electro-hydraulics and full-electric solutions. Their main products are off-the-shelf components and also custom-engineered system solutions for hydrostatic transmissions, open circuit products, orbital motors, valves, steering components and mobile electronics. Globally Sauer-Danfoss employs 7000 workers and has enterprises in America, Europe and in Asia-Pacific. The policy of the whole enterprise is to work diligently to provide a safe and healthy workplace for employees, contractors and visitors. With this effort comes an expectation that each employee accepts personal responsibility for his or her own contributions to safety and safety programs – and results.

The organisation established a system of risk management; however certain aspects of the working environment and manual handling of loads were not managed successfully. The company decided to solve the problems with active employee participation**.**

3.2. Aims

Work at a machinery and equipment production plant involves a number of hazards that can put workers' health and safety at risk. The primarily established risk assessment system was not effective

enough so the company decided to upgrade it with the main aim to improve working conditions of employees by eliminating unfavourable aspects of working environment in order:

- to reduce temperature in the workplace;
- to improve the micro-climatic conditions;
- to eliminate manual handling of loads;
- to reduce the psychological and physical burdens imposed on employees.

The main goals were:

- to establish procedures for the identification of risks which the company can prevent and control;
- to establish a methodology for individual risk assessment in order to identify risks which strongly affect or may affect individual employees' health;
- to establish responsibility for the identification and assessment of risks, approval and updating of registers of OSH risks.

Expected positive effects of improved working conditions due to the effective risk assessment process were:

- undisturbed production;
- higher productivity;
- improved quality of performance and process;
- strengthening of competitiveness.

3.3. What was done, and how?

At the beginning the staff in the enterprise developed a new risk assessment procedure which was adjusted to their specific needs and a document called "OHS Risk Identification, Assessment and Control" was issued. In this document was defined the meaning of all important terms and responsibilities of the staff. The document was made by the safety-technical service (BTS) in corporation with selected workers and subsequently approved by responsible leaders. The head of the assessed workplace together with the selected employee representatives or other invited employees were responsible for the identification of risks, their analysis and evaluation/diagnosis and suggestions of measures for risk management.

The overall risk analysis method consisted of three parts which contained the following data:

1. Identification:

- place of origin – work place, equipment
- profession
- process
- detailed process specification
- equipment/task specification
- danger
- threat

2. Assessment:

- probability of occurrence
- severity (consequence)

- risk – combination of probability and severity

3. Method of risk management – depends on degree of risk.

The methodology of danger evaluation consisted of:

- Probability of accident occurrence: P (see table 1) The assessment of accident occurrence probability is based on the experience of the Safety and health-team and statistics of occurrence of a given accident and injury.
- Consequence (severity) of an accident: Z (see table 2)
- Overall evaluation of risk: R (see table 3)
- Risk characterisation (see table 4)

OSH risk were divided in four categories by the company:

- acceptable
- moderate
- undesirable
- unacceptable.

The prioritisation of risk management tasks was based on previously set criteria, such as:

- level (value) of risk
- severity of consequence
- endangered target (e.g. number of people exposed to such risk, etc.)
- effectiveness and efficiency of proposed measures.

Table 1. Probability of accident occurrence

Probability	Points	Frequency of occurrence	Risk duration
Very high	4	Occurs very often	On-going risk
High	3	Occurs several times during a particular activity (life of equipment)	Frequent risk
Medium	2	Occurs occasionally during the life of equipment or activity	Sporadic risk
Low	1	Occurrence is improbable but possible	Very sporadic risk
Very low	0	Occurrence is almost ruled out	Almost no risk

Table 2. Consequence (severity) of an accident

Type of consequence	Category	Description of consequence
Catastrophic	IV	Death resulting from work injury, or total destruction of system
Critical	III	Severe injury (open fracture, amputation, loss of sensory organ etc.), work-related illness or extensive damage to the system
Borderline	II	Light injury, start of work-related illness or minor damage to the system
Insignificant	I	Less than light injury, negligible system damage

Table 3. Overall evaluation of risk

Probability	Consequence			
	Catastrophic IV	Critical III	Borderline II	Insignificant
4 – very high	20	18	14	8
3 – high	19	16	12	5
2 – medium	17	15	10	3
1 – low	13	11	7	2
0 – very low	9	6	4	1

Table 4. Risk characterisation

Point range	Risk scale	Safety criteria
20 – 16	Unacceptable	System is unacceptable – immediate introduction of protective measures, removal of system
15 - 12	Undesirable	System is dangerous – introduction of protective measures
11 - 4	Moderate	System is safe if proper instruction is given to operators, regular checks, etc.
3 – 1	Acceptable	System is safe, routine procedures

Table 5. List of Hazards OHS

List of Hazards OHS

Version: .
Valid from:

Productteam (PT):

Cost Centre:

Made by - team: BTS, Team leader CC, operators, safety representatives (from operators)

Approved – PT Leader:

Profession	Process	Detailed specification	Equipment	Danger	Hazard	Initial Hazard H = combination P, Z			Control measures	Remain hazard		
						P	Z	H		P	Z	H
metal worker, quality worker	manipulation with material, part	Mechanical, machine	lift truck, el. waste container, transport truck, manual lift truck, rotating arm, clamping fixtures	Physical Danger	pushing a body - LT by the transport truck, container, by load(burden) on the rotating arm, ...	1	III	11	Special training – operation of LT, load (burden) fasten, from operation instruction at operator, prescribed technical survey of equipment, communications and surfaces control, ...			
				Physical Danger	truck turn over, bad floor, irregularly spread load, coincident performance of multiple truck movements by operator,...	1	III	11	Special training – operation of LT, load (burden) fasten, from operation instruction at operator, prescribed technical survey of equipment, communications and surfaces control, ..			

The level of risks is regularly reviewed. The safety-technical service (BTS), the occupational health service (PZS) and employees on all levels were (and are) involved in the process of assessing risks and searching for solutions. General measures for the elimination or reduction of risk were:

1. Removal of risk – used separately from the other three methods. Removal of risk consists of its total elimination (i.e. removal of danger or threat, or both). After removal, the remaining risk is zero.

For example a press with faulty handling (see figure 1) was replaced by a press with two-handed handling (see figure 2), which excludes the possibility of seizure of the worker's hands in time of material pressing.

Figure 1. Press with faulty handling

Source: Sauer Danfoss a.s.

Figure 2. Press with two-handed handling

Source: Sauer Danfoss a.s.

2. Reduction of risk – consists of reducing probability or consequence, or both. Measures to reduce risk are separated into the following two groups:

Technological measures – change of production technology, design adjustment (re-ordering), change in energy sources, energy quantity, energy waste, re-ordering of elements within a system, change of operating principles.

An example is the cleaning and abrasion product technology “Rehashing” with steel taws (see figure 3) has been replaced by isothermal cleaning and abrasion (see figure 4).

Figure 3. Cleaning and abrasion product technology by "rehashing" with steel taws

Source: Sauer Danfoss a.s.

Figure 4. Isothermal cleaning and abrasion

Source: Sauer Danfoss a.s.

Technological measures are the most demanding and most effective.

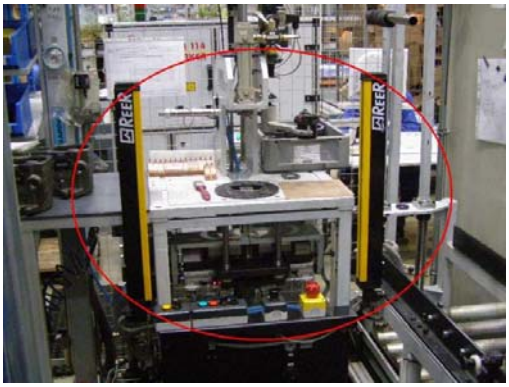
Technical measures: supplementary safety elements – this means active equipment which are added to systems to increase operational safety. Examples are blocking mechanisms, active switches, emergency lighting, back-up sources, automatic circuit-breakers, etc.

An example is a blocking device on the lift truck, which protects the lift truck against using it by unauthorized person – the lift truck is put under a code (see figure 5). An other example are sensors, which in case of a scan field interruption block the device (press) automatically (see figure 6). Furthermore the operator has been replaced by a robot and therefore the operator is not endangered by burns anymore (see figure 7).

Figure 5. Lift truck is put under a code

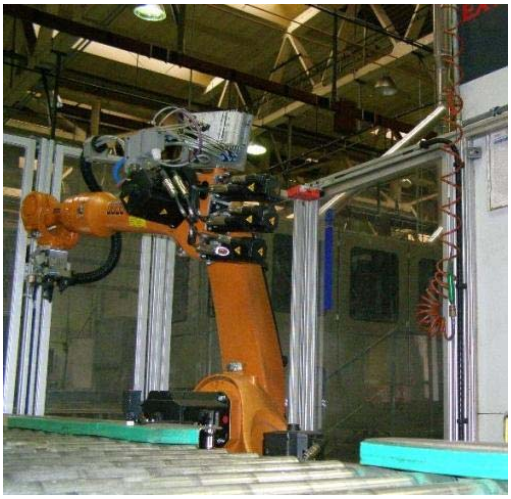
Source: Sauer Danfoss a.s.

Figure 6. Scan field interruption block the device (press) automatically



Source: Sauer Danfoss a.s.

Figure 7. The operator has been replaced by a robot



Source: Sauer Danfoss a.s.

4. Safety (protection) equipment – e.g. barriers, protective shelters, fences, railings, etc. An example is a blowing box protecting the worker from the flying sharp chips at its cleaning process (see figure 8).

Figure 8. Blowing box protecting the worker from the flying sharp chips at its cleaning process

Source: Sauer Danfoss a.s.

5. Warning devices and methods – warn against approaching occurrence or presence of threat; E.g. sirens, horns, traffic lights, warning signs, markings, labels.

6. Personal protective equipment – gloves, eye protection, hearing protection, helmet etc.

7. Organisational measures – instructions, training, work organisation, directives and work procedures, etc.

8. Risk shift – this means shifting the risk to another level (particularly financial). It is applied in the event of a risk which cannot be reduced to an acceptable level, while taking into account possible considerable financial losses. One way of managing such risks is to insure against them with the aim of achieving maximum compensation for potential losses. Another option is to shift the risk on to suppliers.

9. Risk tolerance with the use of current scientific and technical knowledge in case the risk cannot be eliminated or reduced to an acceptable level.

Among other measures, which were inducted are:

- reducing of temperature in summer months in production halls by using the safety curtains, that reflect sunlight and prevent from the penetration of heat through the skylights (see figure 9).
- providing of compliance of the drinking regime by placing the racks with drinking water and beverage vending machines at work places of the company (see figures 10 and 11).

Figure 9. Use of safety curtains to prevent penetration of light and heat

Source: Sauer Danfoss a.s.

Figure 10. Drinking water

Source: Sauer Danfoss a.s.

Figure 11. Beverage vending machines

Source: Sauer Danfoss a.s.

3.4. What was achieved?

Long-term intensive care for the safety and health of employees through the introduction of effective measures resulted in reduced injury rate, psychological and physical well-being of both employees and employer. The worker accident rate has been visibly reduced after taking the measures. There were 3 serious working injuries and several injuries requiring the medical treatment reported in 2008. The company had still no working injury and just 2 cases of medical treatment in 2009. Workers have the possibility through the representatives for safety to express their suggestions and comments, which are reevaluated by the management and subsequently turned into effective measures to eliminate risks or get better quality of the working environment.

3.5. Success factors

The effective system of risk management with active employee participation is now in use. Effective measures for the elimination of risks are constantly being adopted and are regularly reviewed. The safety-technical service (BTS), the occupational health service (PZS) and employees on all levels are involved in this process. The system guarantees employee satisfaction and increases employee interest in the organisation's activities and its smooth functioning. Practice has shown that the costs

invested in employee care are recovered in the form of increased performance and job satisfaction, and a reduction in the rate of injury and incapacity of employees.

Very important facts are:

- The strong involvement of employees into the process of risk assessment improved employee satisfaction;
- The employee interest for the organisation's activities increased.

3.6. Further information

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3.7. Transferability

The approach of solving problems is applicable for other machinery manufacturers. All adopted measures, which have been mentioned are practically applicable in all areas not just the engineering industry.

4. References, resources:

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

Additional information provided by the company.