

INTEGRATING CHEMICAL SAFETY INTO EFFICIENT MANUFACTURING PROCESSES

1 General information

Country: Estonia.

Available language: Estonian, Russian.

The **sector covered** in this case study is manufacture of sheet metal.

Worker groups covered (vulnerable groups): all workers (no specific groups), migrant workers.

The **purpose of this example of good practice** was to improve efficiency by implementing the 5S strategy to eliminate time wasted when looking for tools, chemicals and materials or information, to raise awareness and to help prevent exposure of employees to hazardous substances in the workplace.

The **target groups** are businesses, employers, workers, health and safety professionals.

2 Organisation involved

Saku Metall AS, Tallinn, Estonia.

3 Description of the case

3.1 Introduction

Saku Metall AS is specialised in sheet metal processing. The company works as a subcontractor for big international companies and conglomerates in Europe. Working as a subcontracting factory has a slight positive effect on OSH, as international companies have very high standards in OSH and partly require the implementation of these standards from their subcontractors. Saku Metall AS has been engaged in metal processing for more than 25 years. Overall, around 160 workers are involved in production. Among them, nine are women and more than 30 are migrant workers, mainly from Belarus and Ukraine. Around 90% of the OSH documents (i.e. safety instructions) are available in both languages, in Estonian and Russian.

Saku Metall AS aimed to improve the efficiency of its manufacturing processes and improve the safety of its workers, who handle various chemicals. The main goal was to integrate chemical safety into overall safety management by introducing a comprehensive 5S strategy (see explanation under 3.3) that focuses on chemical safety management (storage and handling of chemicals).

Figure 1. Saku Metall AS (photo: Marina Järvis).



The main chemicals used by the company are those found in welding spray, lubrication chemicals and the dangerous substances used to maintain the cleaning line, such as those in the titrating solution, the graffiti remover (1-methoxy-2-propanol, N-methyl-2-pyrrolidone) and the thinner used with epoxy paints and coatings (containing reaction mass of *m*-xylene, *o*-xylene, *p*-xylene and ethylbenzene, and *n*-butanol). The cleaning line is a fully automated and isolated line, where metal surfaces are cleaned by removing grinding dust, oil tracks and other substances that can affect powder coating quality. The cleaning process consists of five steps, performed by automated pumps and sensors. Even though only a few workers come into contact with chemicals when they add chemicals to the cleaning line dosing tanks, all workers are made aware of the safety measures and how to handle and use chemicals carefully.

3.2 Aims

The project, to implement a 5S strategy, aimed to enhance safety and create a clean, safe and effective workplace with a special focus on chemical safety, as well as to teach workers how to take care of their workplace and train management in the skills of attentive leadership.

The main objectives of the planned tasks were to:

- develop clear routines, procedures and instructions within the established safety system, with a special focus on chemical safety (storage and handling of chemicals);
- enhance the exchange of safety knowledge and the dissemination of the information (from safety data sheets);
- create a new system for the storage of chemicals and implement a labelling programme in both Estonian and Russian, in order to improve the level of workers' safety training;
- optimise the use of chemicals.

3.3 What was done and how?

The layout of the manufacturing plant was changed, and the technology used has also been changing continuously. Because of the large numbers of materials, tools and chemicals, there was lack of space in the plant. Therefore, to improve chemical safety and productivity it was necessary to implement a system to help plan and organise the layout and use of the workplace, so that tools and machinery could be positioned more appropriately, to improve safety as well as reduce non-productive time.

Saku Metall AS designed a project based on '5S' workplace organisational and housekeeping methodology (the 5S strategy) as part of its continuous improvement plan to achieve more efficient manufacturing processes and enhanced occupational safety. The five in 5S refers to the five steps of the strategy — **sort** (*sort needed and unneeded items*); **set** in order (*put things in their proper place and arrange*); **shine** (*clean up the workplace*); **standardise** (*standardise the first three S*) and **sustain** (*make 5S part of working routine*).

The first 'S', 'sort', refers to a waste reduction step. All materials and tools are sorted into those that are necessary and those that are unnecessary, and labelled, so that they can be easily identified. This helps to clean up work spaces as well as improve efficiency by making it easier to find the items required. In addition, a clear overview was compiled on used chemicals, safety data sheets and safety instructions.

One of the most important changes was made in relation to the third 'S', 'shine'. This involves the cleaning of the workplace, the equipment and the machinery. Chemical safety was integrated into the 5S strategy by introducing a separate audit/inspection for chemical safety after the 'sort', 'set in order' and 'shine' stages and before the 'standardise' and 'sustain' steps. By doing this, when employees perform the 'standardise' and 'sustain' steps, they are able to consider both safety issues and efficiency issues.

For the 'standardise' step, new standard procedures and work instructions were prepared, in both Estonian and Russian, and introduced to all employees. The final 'S', 'sustain', relates to the mental and physical discipline of all employees to maintain the other 4 Ss, with a special focus on chemical safety.

The activities carried out were as follows:

- Training was provided for employees and employers with a special focus on migrant workers.
- A new system for the storage of chemicals was developed and a chemical labelling programme, in both Estonian and Russian, has been implemented.
- Training was provided for computer support personnel.

- Clear routines, procedures and instructions were developed within the established safety system, with a special focus on chemical safety (storage and handling of chemicals).
- Instructions and guidelines have been implemented, with regular reviews, audits, feedback and training.
- Loss cards for production have been implemented (see Figure 2). Loss cards are an everyday lean-management tool, which help team leaders and production managers to improve performance in real time (in a 24-hour period). Nightshift operators or powder coating line workers work on their own, without team leaders. Loss cards are their only means of communicating any problems with production processes (poor quality of materials, missing details, problems with equipment, etc.).
- War-room meetings are held for everyday problem solving (see Figure 3).
- The scope of responsibilities and the organisational structure have been defined at all work levels.

Figure 2. Blank loss cards used in production (photo: Saku Metall AS)



Figure 3. An example of a 'to do' list in one of the war rooms (one of the items on the list relates to the need for a new locker for storing chemicals in the welding zone) (photo: Saku Metall AS).

KÄÄLDE, TÄHTEL, KOMPLEKTEERIMISTEHR JA VÄRVITSEHR		KOHITUME IGAL TOOPAVAL KELL		E. K. 12:00	T-R 9:00
02.01	Remikaalide kapp	PS/S	SSUI	02.01	
08.12	4-hall blayout - muidelikes - soos (tegevus)	Ruulan/ TMO		01.02 2018	
28.11	Võn. olutsõand nistatata - KEMIKALIDE ALA	PS/S		2018	
24.11	blavakotade / aluste kott monkeid b. kapp?	RMOR (Ruslan)		2018	
05.01	WR - kaakaantide kott kõrgetes	PS/S / Ruulan Põu / Ruulan		05.01 02.01 2018	
15.12	Tavida ala (investitsioon) sõn. asu	Olav Ruulan		02.01 2018	
04.01	TRAF. -Butter - -Tõetel ainsus ??	And Ruslan		2018	
11.12	blavakotade kapp	And Ruslan		02.01 2018	

When designing the 5S strategy, equipment storage facilities were also reviewed and rebuilt. Some of the new storage facilities are shown in Figure 4.

Figure 4: An example of two new storage cupboards for equipment, installed after the implementation of the 5S system (photo: Saku Metall AS).



Previously, the stamps for punching machines were not stored in accordance with any particular system or in a systematic order. In addition, chemicals that were not used by the punching department were often left in the punching area along with protective gloves and tools. With the new system, only equipment used in the punching department is stored in that area. Chemicals are stored separately in special storing shelves/places and storing places are marked with stickers containing information about possible threats.

Figure 5. An example of the explanations of chemical threats given on packages, in Estonian and Russian, used in each department (these are from folders containing material safety data sheets (MSDs)) (photo: Saku Metall AS)

OHUTLIKKE ASINTE VALMISTISTE OHUSÜMBOLID ALATES 01.06.2015, SONAASES
TÄHEMÄRKID, VANAD OHUSÜMBOLID JA NENDE TÄHELISED TUNNUSED

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ ОПАСНЫХ ВЕЩЕСТВ НАЧИНАЯ С 2015 ГОДА.
СЛОВЕСНОЕ ОПИСАНИЕ, СТАРЫЕ УСЛОВНЫЕ ОБОЗНАЧЕНИЯ УТРОЗ И ИХ
БУКВЕННЫЕ ОБОЗНАЧЕНИЯ

	MÜRGINE / ЯДОВИТЫЙ	
		T, T+
		Xn, Xi
	TULEOHUTLIK / ОГНЕОПАСНЫЙ	
		F, F+
		Xn, Xi
	NAHAÄRRITUS / РАЗДРАЖАЕТ КОЖУ	
		Xn, Xi
	SÕOVITAV / ЕДКИЙ	
		C
	PLAHVATUSOHUTLIK / ВЗРЫВООПАСЕН	
		E
	TERVISEOHUT / МОЖЕТ НАНЕСТИ ВРЕД ЗДОРОВЬЮ	
		T, T+
		Xn, Xi

	OKSÜDEERIV / ОКИСЛИТЕЛЬ	
		O
	KESKKONNAOHUTLIK / ОПАСЕН ДЛЯ ОКРУЖАЮЩЕЙ СРЕДЫ	
	RÕHU ALL OLEV GAAS / ГАЗ ПОД ДАВЛЕНИЕМ	

3.4 What was achieved?

As a result of the development and implementation of the 5S strategy for manufacturing processes, the storage and handling of chemicals (chemical safety management) has improved notably. For example, the maintenance area (where chemicals are handled) and the availability of MSDS information has been improved (see Figure 5 for an example). Special attention has been paid to Russian-speaking workers who need the information in their language.

The management of hazardous chemicals by Saku Metall AS is gradually improving. Workplace inspections/audits shows that the storage of dangerous chemicals has improved as a result of the creation and maintenance of a dedicated storage place, i.e. a special locker was built for the storage of chemicals; floors made from suitable, chemically resistant materials were installed; and a ventilation system, fire alarm, fixed extinguishing system and other alarms were installed. The doors and walls of the central depot are now also fire resistant. For the storage of large containers of chemicals used for surface cleaning on the automated powder coating line, a special storage facility for the plant was developed and built by the Saku Metall AS research and development department. This storage facility is ventilated and has perforated shelves with a collector at the bottom in case of leakages.

In addition, systematic training, in Estonian and Russian, regular inspections/audits of the working environment, and equipment and chemical management are now carried out.

The level of exposure of workers to dangerous chemicals has decreased as a result of an automatic chamber for painting in the powder coating department, installed in 2012. The wet painting technology that was previously used in the establishment was more harmful to employees' health as well as more expensive to use than powder painting technology with an automatic chamber.

In conclusion, the implementation of the 5S strategy at Saku Metall AS has led to:

- daily assessments of whether or not the workplace is clean; four departments — the sheet metal processing (punching and bending) department, the welding department, the powder coating department and the sheet metal processing department — have succeeded in implementing clear routines and instructions within the 5S strategy;
- workers being trained in how to take care of their workplace and handle dangerous chemicals;
- the development of a system for labelling and sorting used chemicals;
- the implementation of a computer system for recording the details of all chemicals used;
- the implementation of loss cards for production as an everyday lean-management tool; these help team leaders and the production manager to improve performance in real time.

3.5 Problems faced

The main problem faced was convincing and motivating employees to contribute and be involved in the development and implementation of the project. Difficulties were encountered with regard to employees' perceptions and attitudes towards the 5S strategy.

One of the challenges is a lack of space in the building, especially for the safe storage of chemicals, because of an increase in the amount of work.

3.6 Success factors and challenges

Several work procedures were reviewed and have been changed.

This project has encouraged workers to take responsibility for improving their working conditions (including chemical safety and ergonomics) and aimed to teach them how to reduce waste, eliminate unplanned downtime and conduct in-process inventories. Chemical safety was integrated into the 5S system by introducing a separate round of audits/inspections for chemical safety issues after the 'sort', 'set in order', and 'shine' steps and before the 'standardise' and 'sustain' steps. By doing this, when employees perform the 'standardise' and 'sustain' steps, they are able to consider both safety issues and efficiency issues.

The key factors that have enabled Saku Metall AS to benefit from the implementation of the 5S strategy are:

- the employer's commitment and the support provided;
- the active involvement of employees — workers at all levels have been involved in the implementation of the '5S' strategy;
- the strategy targeted specific groups (Russian-speaking workers and migrant workers);
- the approach was innovative/inventive — to solve the problem, an innovative solution was proposed to approach the problem from a different angle;
- The approach is transferable — the implementation of the 5S strategy is a good example for other employers, as it could be implemented in/transferred to other establishments.

3.7 Transferability

It is well known that 5S can help make a company lean, but it also can improve OSH (Pasale and Bagi, 2013). This case study demonstrates that a chemical safety management system can be integrated into the '5S' strategy and this could be easily transferred and used by other establishments, especially in the manufacturing sector, or in different countries, as a management tool that helps and motivates employees and employers to improve housekeeping, environmental conditions and OSH.

3.8 Costs and/or economic impacts

A cost–benefit analysis was not performed. However, the costs of the improvements could be divided into two types. First, the direct costs, namely of the materials, equipment and machinery used to implement the improvements in production. For instance, paint and tapes for floor markings, sheet metal costs for the chemical storage facilities, safety stickers, paper for the printed safety instructions and MSDSs. These costs were relatively low, amounting to around EUR 2,000. The second type of costs are the indirect costs, which were connected with staff training, time expenditures, etc.

The largest investment (in the powder coating line) that had an impact on chemical safety at the facility was made in 2012. This is estimated to have been hundreds of thousand euros, but this cost cannot be considered purely an investment in the development of OSH. The powder coating line has clearly had a positive impact on OSH, but the main purpose of the investment was to achieve efficient growth and it was based on rational economic considerations.

However, there is no doubt that all the steps taken to improve the working environment will continue to have a positive impact. Well-informed and -protected workers are less likely to be affected by occupational diseases and are at less risk of incidents in the workplace, and, therefore, their physical and mental well-being is protected. Workers whose welfare is protected by their employer are more likely to be highly motivated and productive, meaning that employers have to spend less as a consequence of high rates of workforce turnover. This means that if a company acts in a proactive way and invests rationally in OSH, the gain from these investments will be real and measurable. Proactive behaviour could also help to prevent future problems: proactive approaches are more effective than reactive approaches.

3.9 Evaluation

The current case study is a good example of chemical safety management for a combination of reasons:

- Using the 5S strategy is simple.
- The results of the 5S strategy are visible within a short period.
- The costs of implementing the 5S strategy are low.
- The 5S strategy leads to a reduction in costs.
- The strategy has a positive impact on employees' morale and involvement.
- A better level of health and safety, as well as an increase in employers' and employees' awareness, was achieved.
- It demonstrates the employer's commitment.
- It is easy to understand.
- It is transferable.

3.10 Further information

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4 References and resources

Pasale, R. A., Bagi, J. S., 2013. 5S strategy for productivity improvement: a case study. *Engineering* 2(3): 151-153.

Saku Metall AS. Available at: <https://sakumetall.ee/en/>