

## CONTROLLING EXPOSURE TO DANGEROUS CHEMICALS WHEN TREATING SURGICAL INSTRUMENTS

### 1 General information

**Country:** Latvia.

**Available language:** Latvian.

The **sector covered** in this case is healthcare.

Task covered: healthcare.

**Worker groups** covered (vulnerable groups): all groups.

The **purpose of this example of good practice** was to improve the work environment in the department of sterilisation and disinfection of surgical postoperative instruments.

The **target groups** are employers, managers, and health and safety managers.

### 2 Initiator/organisations involved

Pauls Stradiņš Clinical University Hospital, Riga, Latvia.

### 3 Description of the case

#### 3.1 Introduction/background

Pauls Stradiņš Clinical University Hospital was founded in 1910 and was originally called the 'Second Riga City Hospital'. Today, it is the second largest hospital in Latvia. It covers an area of more than 15 hectares. It has 34 administrative divisions in 26 buildings, whose total area is more than 100,000 m<sup>2</sup>.



Plan (left) and photo (right) of Pauls Stradiņš Clinical University Hospital.

Around 3,000 people work in the hospital. Medical services are provided to more than 300,000 patients a year. The administrative and support functions of the hospital are implemented by the Board and the hospital comprises 18 units, 15 departments and 1 institute.

There are 9 clinics and 17 centres in the treatment and care departments, 11 of which are in the clinic structure. They also have a polyclinic, four surgical units, a laboratory and two institutes (the Institute of Diagnostic Radiology and the Institute of Pathology).

Pauls Stradiņš Clinical University Hospital is a multi-field medical treatment institution in Latvia, which provides extensive diagnostics and treatment to patients. It also carries out scientific research work and trains young medical specialists.

**Picture: sterilisation equipment using ethylene oxide.**



Many interventions were made during a large EU-project with aid from the EU.

Around 20 people work in the central sterilisation department and, of these, 10-15 work with equipment. The department is located on the ground floor; it was specially designed and built away from external walls, with fireproof compartments and separated ventilation systems, and is equipped with an access control system for authorised persons only.

Ethylene oxide gas sterilisers have been used by the hospital for many years to sterilise surgical equipment and supplies that are heat sensitive or cannot tolerate excessive moisture. In other countries, ethylene oxide is also used to produce sterility at room temperature. Ethylene oxide has been recognised as a potential mutagenic, reproductive, carcinogenic, neurological, and fire and explosion hazard to hospital workers (Jho et al., 2007).

The Pauls Stradiņš Clinical University Hospital built a building that is separated from the main hospital, to collect and store technological gases, in particular compressed steam.

In the room where ethylene oxide is used and stored, local exhaust systems and gas analysers are installed. Furthermore, in case the equipment does not stop working in a dangerous situation, there are gas masks and other personal protective equipment located in the department. Ethylene oxide is stored in disposable cartridges in fireproof cabinets in the same room where sterilisation equipment is located.

In addition, each department where hazardous chemicals are used is equipped with gas analysers. Each piece of equipment also has emergency exit pipes. During an emergency, the pipes will open and gas and volatile dangerous chemicals will be directed outside the room.

Every year, the hospital organises an emergency training course to ensure that all workers who work with chemicals and equipment, particularly technical staff, are properly trained.

**Substance description:** the chemical used by the workers is ethylene oxide, which is used during hospital sterilisation of surgical equipment. Ethylene oxide is a flammable, colourless gas.

**Hazards physical state:** liquids, aerosols, gases.

**Hazard health effect:** a potential mutagenic, reproductive, carcinogenic or neurological irritation.

Exposure to ethylene oxide can cause eye pain, a sore throat, difficulty breathing and blurred vision. It can also cause dizziness, nausea, headache, convulsions and blisters and result in vomiting, coughing, genetic damage, nerve damage, peripheral paralysis and muscle weakness as well as impaired thinking and memory.

**Exposure route:** dermal, inhalation.

## 3.2 Aims

The aim of all activities is to minimise the exposure of all medical staff and workers to chemical substances and their products, ensuring the safe storage, mixing and delivery of chemicals in separate rooms, and safe delivery to washing, disinfection and sterilisation equipment through pipelines.

## 3.3 What was done and how?

On 1 June 2017, the hospital opened a new building for the disinfection and sterilisation department. This building is fully equipped with security systems; all safety systems are connected and can be controlled via the building management systems.

Currently, an air control system for the disinfection department, an air-conditioner and a closed piece of automatic equipment for soaking contaminated instruments have been installed. The hospital made it possible to carry out almost every sterilisation process with technical solutions. Manual pre-treatment or initial cleaning is still obligatory for certain instruments, such as flexible endoscopes and rigid instruments with lumens, which are medical instruments for invasive surgeries.

Through a complex approach, it was possible to minimise the exposure to hazardous chemicals, particular to ethylene oxide, in the department for sterilisation and disinfection of surgical postoperative instruments. This approach consists of the following elements:

1. Exposure was prevented through the use of the latest generation of ethylene oxide steriliser. These sterilisers are safer because they continuously control airflow, ethylene oxide presence and concentration.
2. Additionally, gas analysers have been installed for every area where chemical leakage could occur.

Equipment in which dangerous chemicals are used is kept in fireproof cabinets or in fireproof compartments that have separate exhaust systems, to minimise exposure to the chemicals noticeably.

Workers are trained to handle dangerous chemicals and equipment. Collectors and other equipment are maintained by professionals and experts.

Much attention is paid to fire safety and possible emergency situations.

## 3.4 What was achieved?

An effective management system of chemical hazards, particularly ethylene oxide, was achieved through a technical approach, namely through

- elimination of the hazardous agent from the main hospital building,

- effective training of workers who handle ethylene oxide and other chemicals,
- and the continuous provision and maintenance of technical equipment, carried out by specialists and experts.

The working conditions in the department of disinfection of surgical postoperative instruments were effectively improved. Workers are satisfied with the working conditions.

The premises where ethylene oxide is used are equipped with access control systems, which allow entry only for authorised persons.

### 3.5 Problems faced

In almost all areas where chemicals were used, there was no separate room for storage of chemicals.

At the beginning, workers complained about the large number of training courses. It took time to train them and to convince them to follow safety requirements and to read instructions and manuals for chemicals. Technical devices were new and the technical staff needed to adapt their skills and to change some habitual working practices.

Some workers have a low level of education and it was a challenge to motivate them. It has taken some time and effort to explain to workers that certain ways of handling dangerous chemicals were already or are now strictly prohibited.

A major challenge was understanding the risks, because not every chemical agent can be smelled.

### 3.6 Success factors and challenges

The current chemical safety management system in the hospital has significantly reduced the health risks from exposure to ethylene oxide.

Several work procedures were reviewed and have been changed. As a result of the implementation of the technical solutions and automated processes for transfer and collection of ethylene oxide, the working conditions have improved considerably, all guidelines about chemical safety were reviewed and revised and, because of this, training for workers is now more focused, concrete and effective.

This project encourages workers to follow safety guidelines, improves working conditions and helps them to learn to reduce health risks caused by ethylene oxide as well as by waste.

The key success factors of the current interventions are:

- Employers were committed and provided support.
- Workers were actively involved. Workers at all levels were involved in the implementation of interventions (through training, discussion, observation, feedback and risk assessment).
- Specific problems were solved by focusing on preventing risks at source.
- An innovative solution was found to solve the problem and this resulted in the implementation of EU good practice in a Latvian hospital.

### 3.7 Transferability

It is possible to transfer the current case to other establishments in the healthcare sector and to other countries.

### 3.8 Costs and/or economic impacts

First, the new technology is easier to use, safer and faster. However, the equipment is more expensive (approximately 70 %). The resultant savings are about 63 %. Second, loading the equipment is more ergonomic and easier for the operator.

The hospital has not calculated the exact costs and economic impact of the intervention in the department. Around EUR 4-5 million was spent on technical solutions in the sterilisation and disinfection department. The European Union financed 50 % of these costs.

### 3.9 Evaluation

The case study:

- comes from a credible source;
- is easy to understand for the user;
- is transferable to other companies/countries;
- involves a realistic work situation;
- focuses on preventing risks at source;
- is targeted to specific problem solving (eliminating exposure to ethylene oxide).

### 3.10 Further information

#### Contact

Matīss Šmitiņš

Pauls Stradiņš Clinical University Hospital

Pilsõņu iela 13, Rīga, LV-1002, Latvia

Email: [matiss.smitins@gmail.com](mailto:matiss.smitins@gmail.com)

About Pauls Stradiņš Clinical University Hospital: <http://www.stradini.lv/lv>

## 4 References and resources

Jho, D. H., Neckrysh, S., Hardman, J., Charbel, F. T., Amin-Hanjani, S., 2007. Ethylene oxide gas sterilization: a simple technique for storing explanted skull bone. Technical note. *Journal of Neurosurgery*, 107(2):440-445.