

## Data for SF<sub>6</sub> – technology with respect to environment and safety

### Properties of SF<sub>6</sub>

- global warming potential in comparison to CO<sub>2</sub> is 22'800 times higher
- lifetime in atmosphere is about 3200 years
- no ecotoxic potential is known so far
- no depletion of ozone layer
- minor load in case of fire

### Technically uncomplicated systems

- low resource consumption
- independent from weather conditions

### Low susceptibility to faults and failures

- high safety through insulated metallic shielding

### Long service life of switchgear

- economical raw materials and power use
- easy disposal

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## Swiss voluntary agreement for the use of SF<sub>6</sub> in Particle Beam Accelerators (Electron and Proton Beam Accelerators)

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Technology with Passion

 **HUBER+SUHNER**

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**VARIAN**  
medical systems



Solvay  
Fluorund Derivate 

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## Emissions reduction guidelines for Swiss operators of SF<sub>6</sub>-containing particle beam accelerators

Operators and users of particle beam accelerators, being aware that SF<sub>6</sub> is classified as a very stable and effective greenhouse gas, act according to the following principles:

### Emissions of SF<sub>6</sub> shall be avoided whenever possible.

### Operators and users aim at limiting SF<sub>6</sub> – emissions in Switzerland to less than 0.5 tons (2012), reducing to 0.45 tons (reduction until 2020) per year respectively from the operation of SF<sub>6</sub>-containing particle beam accelerators.

The companies endorsing this declaration subscribe to the following measures:

- When purchasing new or replacing old equipment SF<sub>6</sub>-technology is given preference only if it offers significant advantages.
- During installation, operation and maintenance of SF<sub>6</sub>-containing particle beam accelerators measures in line with the most recent techniques are implemented in order to avoid emissions of SF<sub>6</sub>.
- The same applies to manufacturing, transportation and storage of SF<sub>6</sub>, as well as to all arrangements in connection with re-use, recycling or disposal of SF<sub>6</sub>.
- As a rule, gas-filled compartments are permanently monitored in order to detect and quickly repair any leakage of SF<sub>6</sub>.
- Operators keep the leakage rate under normal operating conditions to less than 3% per year.
- The improvement management described in the Memorandum of Understanding has to be met.
- As a rule SF<sub>6</sub> is only use in closed systems.

- Switchgear manufacturers, SF<sub>6</sub> distributors, SF<sub>6</sub> users and SF<sub>6</sub> disposal companies are committed to ensure that used SF<sub>6</sub> is re-used. For SF<sub>6</sub> that cannot be re-used, environmentally correct disposal is assured. SF<sub>6</sub> manufacturers and distributors will provide specific information upon request.
- SF<sub>6</sub>-handling staff is trained on a regular basis.
- Maintenance is carried out by qualified staff only.
- Operators urge equipment manufacturers to improve their technology in order to reduce SF<sub>6</sub>-emissions.
- For exports, the same quality standards and services apply - this includes the handling of SF<sub>6</sub>.
- Manufacturers and distributors of SF<sub>6</sub> keep a statistical record of SF<sub>6</sub> quantities produced and delivered. Operators of particle beam accelerators will keep a statistical record of SF<sub>6</sub> consumption and stocks.
- Manufacturers and distributors of SF<sub>6</sub> and operators of SF<sub>6</sub>-filled particle beam accelerators provide the Federal Office for the Environment (FOEN) with requested statistical data.
- A SF<sub>6</sub> monitoring survey is carried out on a yearly basis. The survey provides information about the use of SF<sub>6</sub> in particle beam accelerators in Switzerland.

This declaration is part of a voluntary agreement, which is recognised by the FOEN accordance with Art. 41a of the Environmental Protection Law (USG). The voluntary agreement consists of the present declaration from operators of particle beam accelerators, the corresponding declaration from switchgear manufacturers and handlers, the guideline for users, provided by the Swiss Electric Utility Association (VSE), and the Memorandum of Understanding between the FOEN and Swissmem (2013).

## Use of SF<sub>6</sub> as an insulating and arc quenching gas in particle beam accelerators

### Stock in Switzerland (2012):

About 12,6 t in particle beam accelerators in Switzerland.

### Application:

In sealed, monitored systems. The leakage rate is less than 3% per year.

### Lifetime of switchgear:

Depending on the installation at least 10 years (x-ray apparatus), or 25 years (electron accelerator), respectively.

### Emissions:

Quantities emitted are limited during normal use. They occur particularly due to gas transfers for maintenance, partly also due to improper handling during production, testing and maintenance. Larger emissions are possible due to leakage and disturbances in service.

### Removal and Re-use:

SF<sub>6</sub> can be safely and properly removed in an environmentally compatible manner. SF<sub>6</sub> gas is routinely reclaimed and re-used.

### New technologies:

No short and medium term solution is available. Taking into account the technical, economic and ecological point of view, no better alternatives to SF<sub>6</sub> as an insulating and arc quenching medium are currently known.