Swiss voluntary agreement for the use of SF_6 in Particle Beam Accelerators (Electron and Proton Beam Accelerators)

Guidelines for reducing emissions from particle beam accelerators

Being aware that SF_6 is classified as a very stable and effective greenhouse gas, Swiss users and manufacturers of particle beam accelerators containing SF_6 act according to the following principles:
Emissions of SF_6 shall be avoided if possible.

From 2026, manufacturers and users aim at limiting SF_6 – emissions in Switzerland to less than 0.25 tons per year from the operation of particle beam accelerators.

The companies endorsing this declaration subscribe to the following measures:

- When purchasing new or replacing old equipment SF_6-free technologies are used wherever technically possible.
- During installation, operation and maintenance of SF_6-containing particle beam accelerators measures in line with the most recent techniques are implemented in order to avoid emissions of SF_6.
- The same applies to manufacturing, transportation and storage of SF_6, as well as to all arrangements in connection with re-use, recycling or disposal of SF_6.
- To the extent possible, gas-filled compartments are permanently monitored in order to detect and quickly repair any leakage of SF_6.
- Operators keep the leakage rate under normal operating conditions to less than 3 per cent per year.
- SF_6 is used in closed systems.
- Manufacturers of systems containing SF_6, SF_6 distributors, SF_6 users and SF_6 disposal companies are committed to ensure that used SF_6 is re-used. For SF_6 that cannot be re-used, environmentally correct disposal is assured. SF_6 manufacturers and distributors will provide partners with the information required to ensure proper disposal.
- SF_6-handling staff is trained on a regular basis.
- Maintenance is carried out by qualified staff only.
- Operators of industrial particle beam accelerators urge equipment manufacturers to improve their technology in order to reduce SF_6-emissions.
- In the event of an accident, the following information will be recorded in writing and submitted to Swissmem as part of the annual reporting: a description of the incident, a calculation or estimate of the SF_6 gas losses, the results of the investigation to establish the cause, and a list of the improvement measures to be implemented. An exchange of experiences between the bodies responsible for the voluntary agreement and with the Federal Office for the Environment (FOEN), while respecting company and trade secrets, should contribute to avoiding similar occurrences in future, including for other businesses participating in the SF_6 voluntary agreement.
- Manufacturers and distributors of SF_6 keep a statistical record of SF_6 quantities produced and delivered. Operators of industrial particle beam accelerators containing SF_6 and manufacturers of medical particle beam accelerators containing SF_6 keep a record of SF_6 consumption and stocks.

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- Manufacturers and distributors of SF_6 and operators of particle beam accelerators containing SF_6 report these quantities to Swissmem. Swissmem will treat this information as confidential except for the data it is permitted to provide to the FOEN.
- Swissmem will compile an annual SF_6 assessment from this data which provides information about the use of SF_6 in particle beam accelerators in Switzerland.
- In the event that the annual emissions target is exceeded, an investigation into the causes for this will be carried out within the voluntary agreement.
- The stakeholders in the voluntary agreement are initiating a dialogue on a long-term reduction path for SF_6.

Use of SF_6 as an insulating and arc quenching gas[1] in particle beam accelerators

Stock in Switzerland (2024): About 12,3 t in particle beam accelerators in Switzerland.

Application: In sealed, monitored systems. The leakage rate is less than 3 per cent 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.

Re-use: SF_6 gas is routinely reclaimed and re-used.

Removal: SF_6 will be safely and properly removed in an environmentally compatible manner.

New technologies without SF_6: No short and medium term solution is available. Taking into account the technical, economic and ecological point of view, no better alternatives to SF_6 as an insulating and arc quenching gas for industrial and medical particle beam accelerators are currently known.

This declaration is part of a voluntary agreement for SF_6 for operators of particle beam accelerators, which is recognised by the FOEN in accordance with Art. 41a of the Environmental Protection Law (USG).

[1] The term "quenching gas" here signifies the use of SF_6 for the purpose of arc quenching.