Product stewardship

- Product stewardship is defined as

  The responsible and ethical management of the health, safety, and environmental aspects of a product throughout its life-cycle

- Product stewardship is:

  “Responsible care” applied to products!
Product stewardship for SF$_6$: communication

- Leaflet from VDEW and ZVEI (German electrical associations)

Voluntary self commitment of GIS manufacturers, GIS users, and SF$_6$ producers to undertake efforts with respect to the state of the art to minimise SF$_6$ emissions.

This voluntary self commitment of all participants may assure a maximum protection of the product by guaranteeing a minimisation of emissions.

Further **co-operation** developing new facts and describing the real environmental impact of SF$_6$ technology will support the environmental discussion and the assessment of SF$_6$. 
Established product stewardship for SF$_6$:

- **Anchoring in the company**
  
  Target: To continue to improve the quality of products and services

- **Safety and environmental protection as goals**
  
  Risk management: SF$_6$ ReUse concept

- **Communication**
  
  Voluntary commitment:
  
  “Use of SF$_6$ in Switchgears and GIS (Gas Insulated Substations)”

- **Co-operation**
  
  Life Cycle Assessment Study: “Electricity Supply Using SF$_6$ Technology”
SF₆ and the environment

Environmental impacts:
- SF₆ has no ODP
- SF₆ has no ecotoxic potential
- But SF₆ is a greenhouse gas: GWP = 23,900 (ITH = 100 a) atmospheric lifetime = > 3,000 a

Conclusion:
→ Minimising emissions!

Improvement already achieved:
- 27% reduction of global annual SF₆ emissions between 1995 and 1998¹

What do we expect?
- Further growth in demand for energy efficient electricity distribution systems with minimised environmental impact
- Further decline of annual emissions into the atmosphere due to
  - Closed systems
  - Responsible handling
  - ReUse concepts
- Less than 1% SF₆ contribution to the greenhouse effect by 2010

Support for environmental assessment

• In general about $\text{SF}_6$:

• The $\text{SF}_6$ ReUse folder and (especially environment-related) the $\text{SF}_6$ Newsletter

• With application-related problems on $\text{SF}_6$:

• Special advice including all available measures, e.g., IEC 376, IEC 480, IEC 1634, CIGRE documents, etc.
# Specification

<table>
<thead>
<tr>
<th>Impurity</th>
<th>IEC Norm 376</th>
<th>Solvay Specification</th>
<th>Maximum Impurity Limits*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air in ppm by weight</td>
<td>500</td>
<td>150</td>
<td>300000</td>
</tr>
<tr>
<td>CF&lt;sub&gt;4&lt;/sub&gt; in ppm by weight</td>
<td>500</td>
<td>50</td>
<td>50000</td>
</tr>
<tr>
<td>H&lt;sub&gt;2&lt;/sub&gt;O in ppm by weight</td>
<td>15</td>
<td>0.65</td>
<td>1000</td>
</tr>
<tr>
<td>Hydrolysable fluorides, in terms of HF in ppm by weight</td>
<td>1</td>
<td>1</td>
<td>1000</td>
</tr>
<tr>
<td>Mineral oil in ppm by weight</td>
<td>10</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

For impurities not mentioned (e.g., SOF<sub>2</sub>, SO<sub>2</sub>F<sub>2</sub> etc.), Solvay will assist upon request.

*Reclaimable by Solvay
Recycling and re-use
SF₆ ReUse concept

• Precleaning of used SF₆ to remove particles

• Feeding into the cleaning process for new SF₆

• Reclaiming without residues
  (as decomposition products in used SF₆ are fed back into the SF₆ production reactors together with byproducts in the raw material)

• Possibility to incinerate used SF₆
  (in case reclaiming is impossible)
Life cycle assessment

Electricity supply using SF_{6} technology:

This project compared different types of switchgear, with (GIS) and without (AIS) SF_{6} technology, at the levels of switchgear bays and of a practical power supply grid (for a city with 130,000 inhabitants).
SF₆ and climate protection - implemented life cycle management -

- Voluntary commitments
- SF₆ ReUse concept
- Systems optimisation by LCA approach

Power supply of a 130,000-inhabitant city

<table>
<thead>
<tr>
<th></th>
<th>Electricity supply grids - SF₆ vs. SF₆-free -</th>
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</thead>
<tbody>
<tr>
<td>Energy</td>
<td>☺</td>
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<tr>
<td>Area</td>
<td>☺</td>
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<tr>
<td>GWP (global warming)</td>
<td>☺</td>
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<tr>
<td>AP (acid rain)</td>
<td>☺</td>
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<tr>
<td>NP (nutrification)</td>
<td>☺</td>
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</tbody>
</table>

Without SF₆ technology       With SF₆ technology
Result of the LCA on SF$_6$

Reduction of potential environmental impacts studied by use of GIS (SF$_6$) switchgear in the power supply system considered compared to AIS switchgear technology.

Systems level

<table>
<thead>
<tr>
<th></th>
<th>AIS in %</th>
<th>GIS/SF$_6$ in %</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
SF₆ and climate protection

- Responsible use of SF₆

- SF₆ emissions trend broken: 1995-1998 27% less

  (Maiss, Brenninkmeijer “A reversed trend in emissions of SF₆ into the atmosphere?” 2nd Symposium on Non-CO₂ Greenhouse Gases (NCGG 2), 8-10 September 1999 in Noordwijkerhout)

- Ecological system benefits of SF₆ use exceed potential impacts