SF_6 Emission Reduction

At the Point of SF_6 Production

28/05/2014

AGENDA

1. Solvay – brief presentation
2. SF_6 basics
3. SF_6 Emission Reduction during production and filling
4. SF_6 ReUse Process
5. Summary

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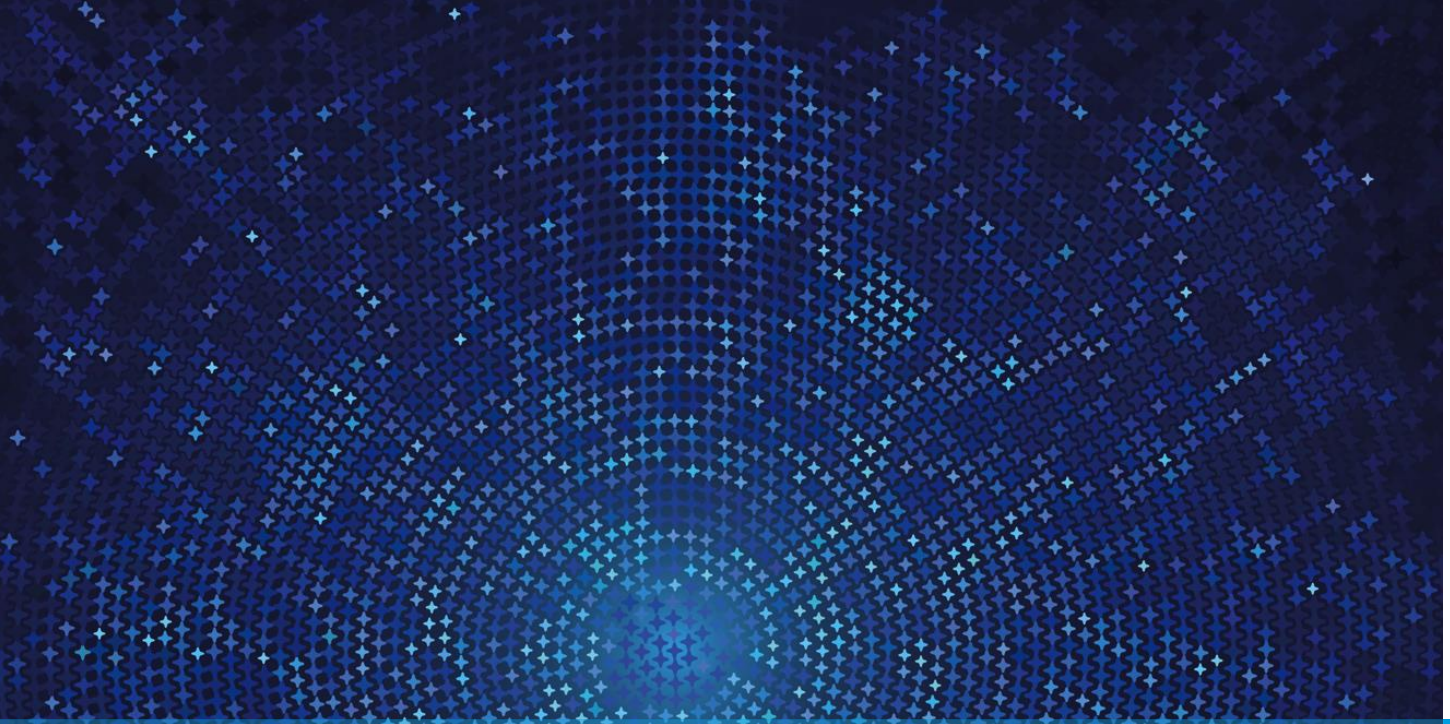

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Solvay
Company Presentation

Brief

28/05/2014

Who is Solvay?

A major global player in Chemicals with compelling strengths

Created by Ernest Solvay in 1863, Solvay is a **Global** company, with historical anchorage in Europe, and headquartered in Brussels.

Our strengths

- **90% of sales** in businesses among the **top 3 global leaders**
- A **balanced portfolio of activities**, directed **at growth regions**
- A culture of **sustainability, innovation and operational excellence**

€9.9 bn
NET SALES

€1,663 bn
Adjusted REBITDA

117
INDUSTRIAL SITES

15
MAJOR R&I

29,400
EMPLOYEES
55 COUNTRIES

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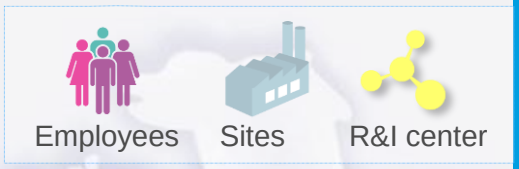
Historical strength in fast-growing regions



EUROPE
33% sales
15,800 49 8

ASIA PACIFIC & REST OF THE WORLD
31% sales
6,000 28 4

NORTH AMERICA
25% sales
3,700 33 2

LATIN AMERICA
11% sales
3,900 7 1

A balanced portfolio of activities, directed at growth regions

2012 figures

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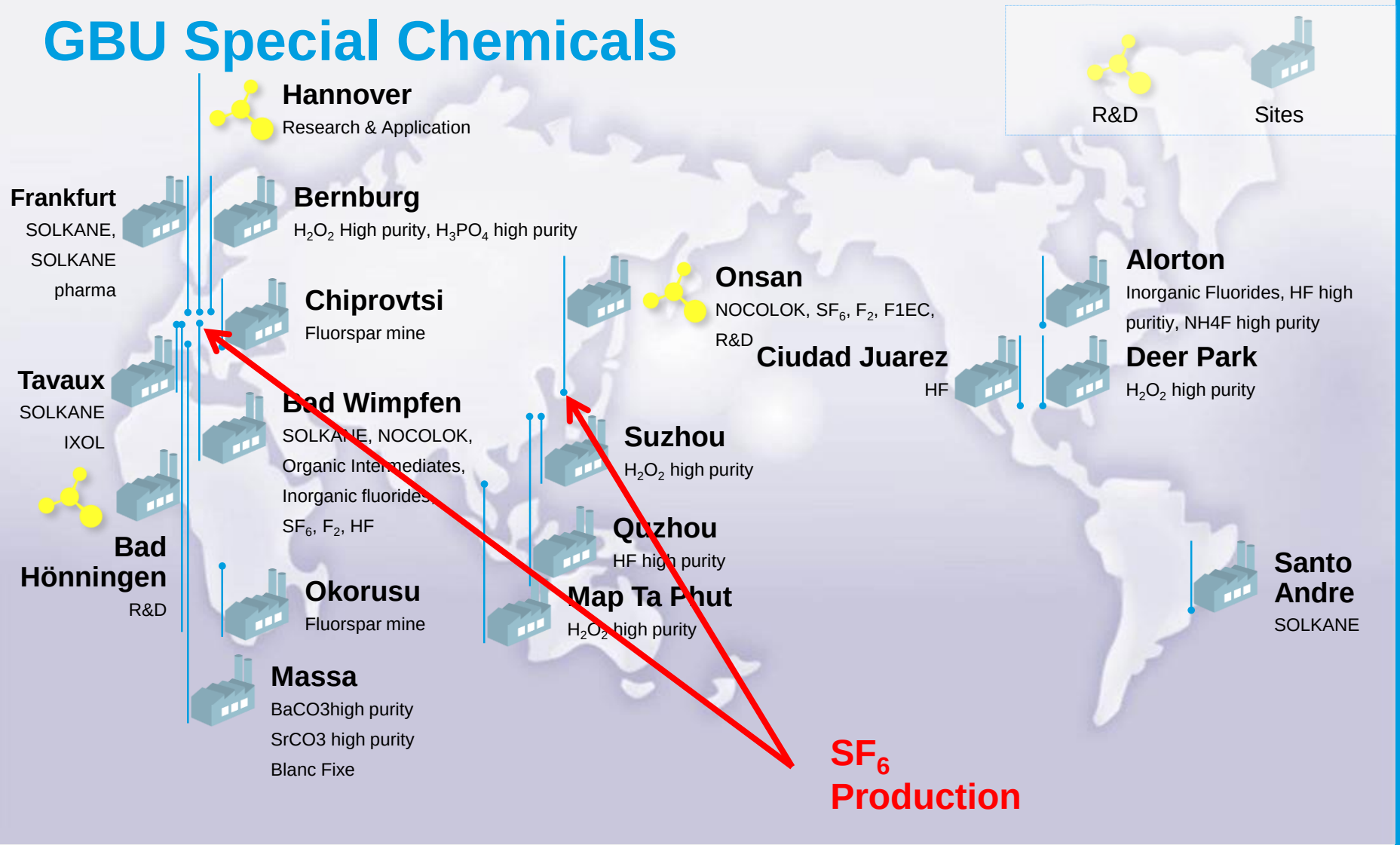
GBU Special Chemicals



Bad Wimpfen, Germany Plant

Onsan, South Korea Plant

SF_6 – Basics

Where we do stand

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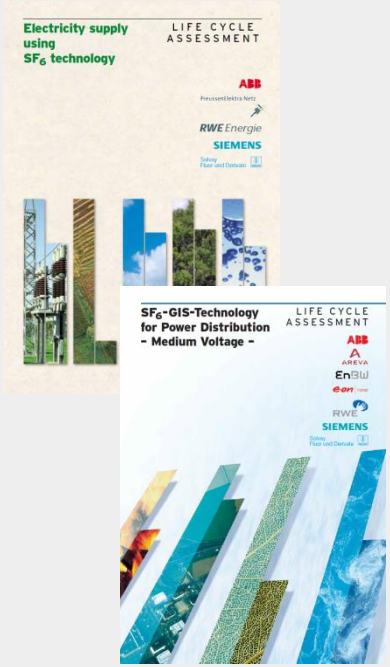
The SF_6 Basics

- SF_6 has proven to be highly efficient in transmission and distribution equipment and switchgear because of its unique properties such as chemical inertness, high thermal stability, non-flammability, and non-toxicity.
- Life Cycle assessment studies have proven that using the SF_6 technology leads to considerable environmental advantages.
- Despite the advantages, SF_6 is a potent greenhouse gas covered by the Kyoto Protocol. Any emissions must be avoided as far as possible and the product must be handled within closed loop systems.
- Although significant efforts have been made in the past years, so far no viable alternative to SF_6 has been found offering the same advantages and performance.



SF_6 Emission Reduction

In production, filling and quality control

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SF_6 Emission Reduction at the point of production

Interventions at our plants

- Emission free filling system
  - The use of dedicated piping allow to send to the treatment system any potential release of gas during filling
- Plasma burner to treat off-gas streams
  - Due to its exceptional stability, it is essential to reach temperature >4000°C to efficiently crack SF_6
- Reduction of energy consumption (indirect emissions)
- Implementation of emission free sampling
  - This allows us to check product quality without causing any emission into the atmosphere

SF_6 Emission Reduction at the point of production

Emission free filling system

Procedure:

1. Connect
2. Vacuum
3. Valve opening
4. Filling with SF_6
5. Valve closing
6. Evacuation of residual gas in filling pipe
7. Residual gas is collected and reprocessed in the plant

SF_6 Emission Reduction at the point of production

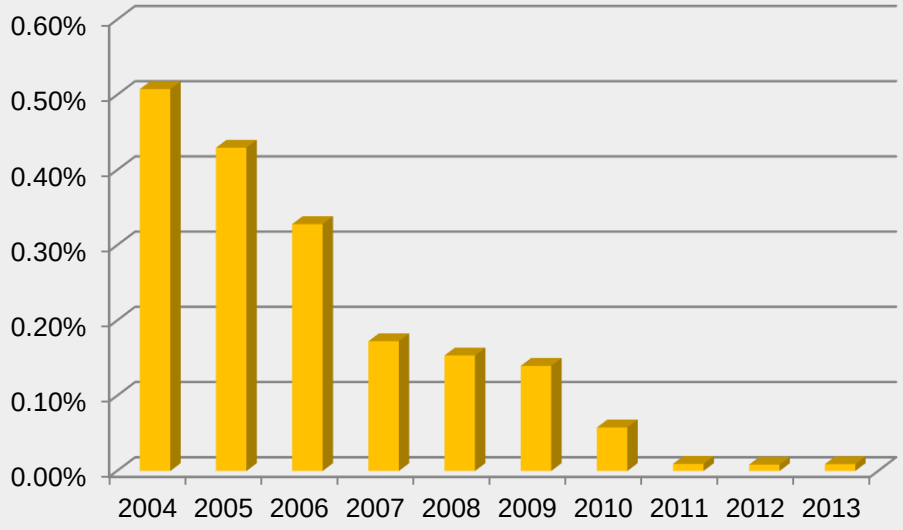
Emission free sampling system

The picture shows one of our sampling systems in the plant. The sample cylinders are inserted with fast connectors that do not have “free room” where SF_6 might accumulate and be emitted. The sample cylinders are then transported to the laboratory to be analyzed.

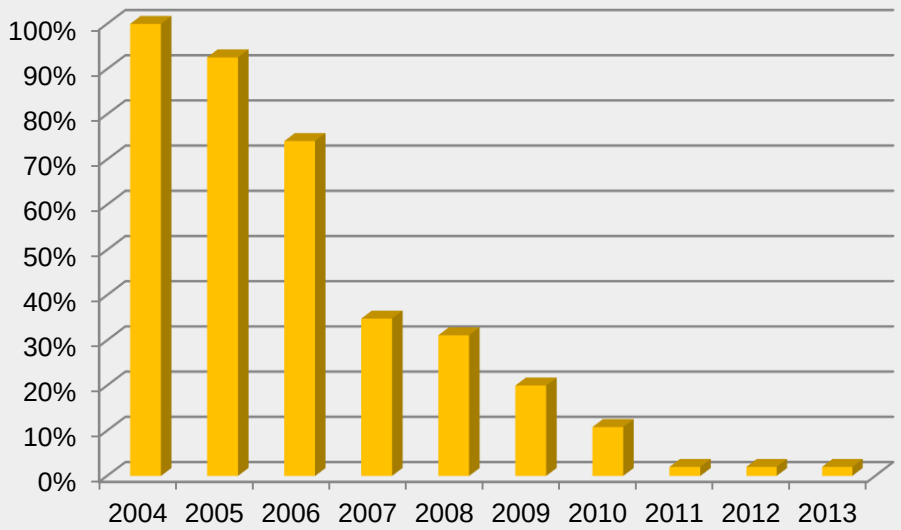
SF_6 Emission Reduction at the point of production

Bad Wimpfen impressive trend

SF_6 emissions in % of production volume



Total SF_6 emissions trend at the production site



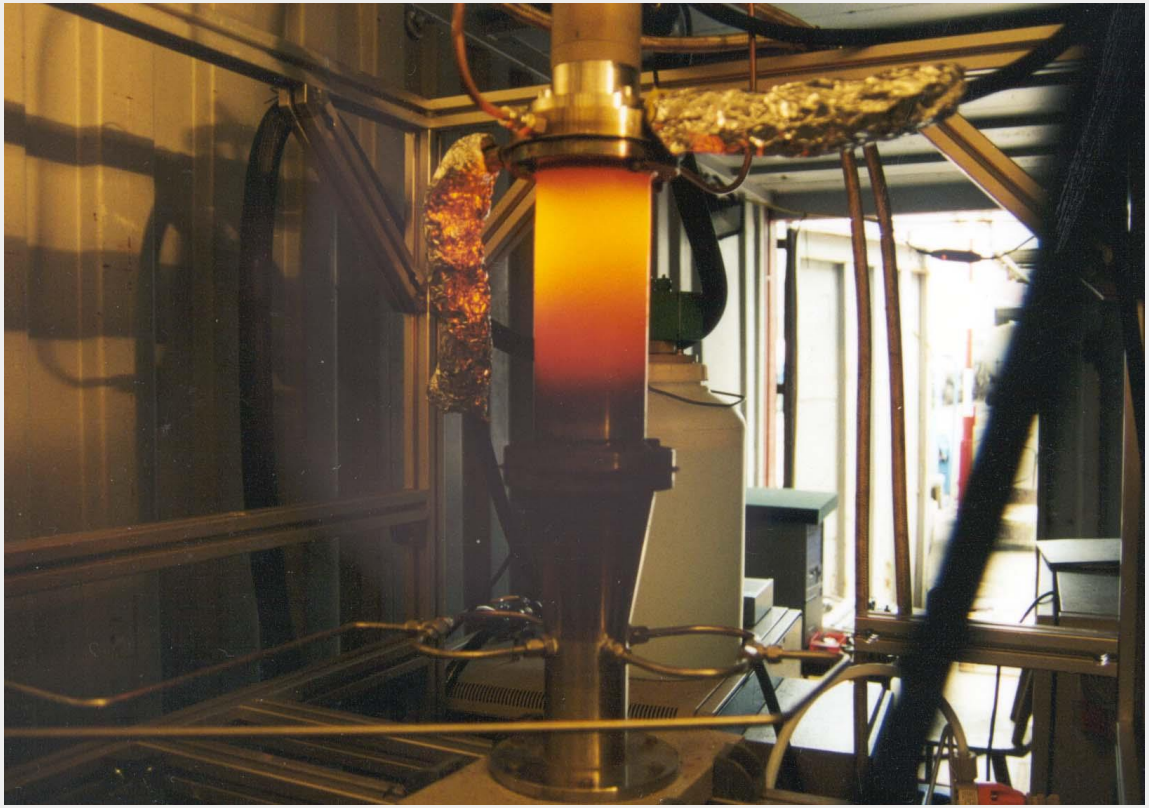
SF_6 Emission Reduction at the point of production

Measurement

- Direct emissions are measured in the exhaust
  - Continuous analysis (IR und UV) of plant off-gases
  - Emissions (after plasma burner) are analyzed with GC
- Diffusive emissions are estimated:
  - Emissions caused by gasket porosity are estimated
  - Tightness of connections is regularly checked
  - Procedure is in place
- Indirect emissions are calculated:
  - Indirect greenhouse emissions caused by energy consumption are included and are calculated considering the “electricity production mix” of Germany and Korea.

SF_6 Emission Reduction

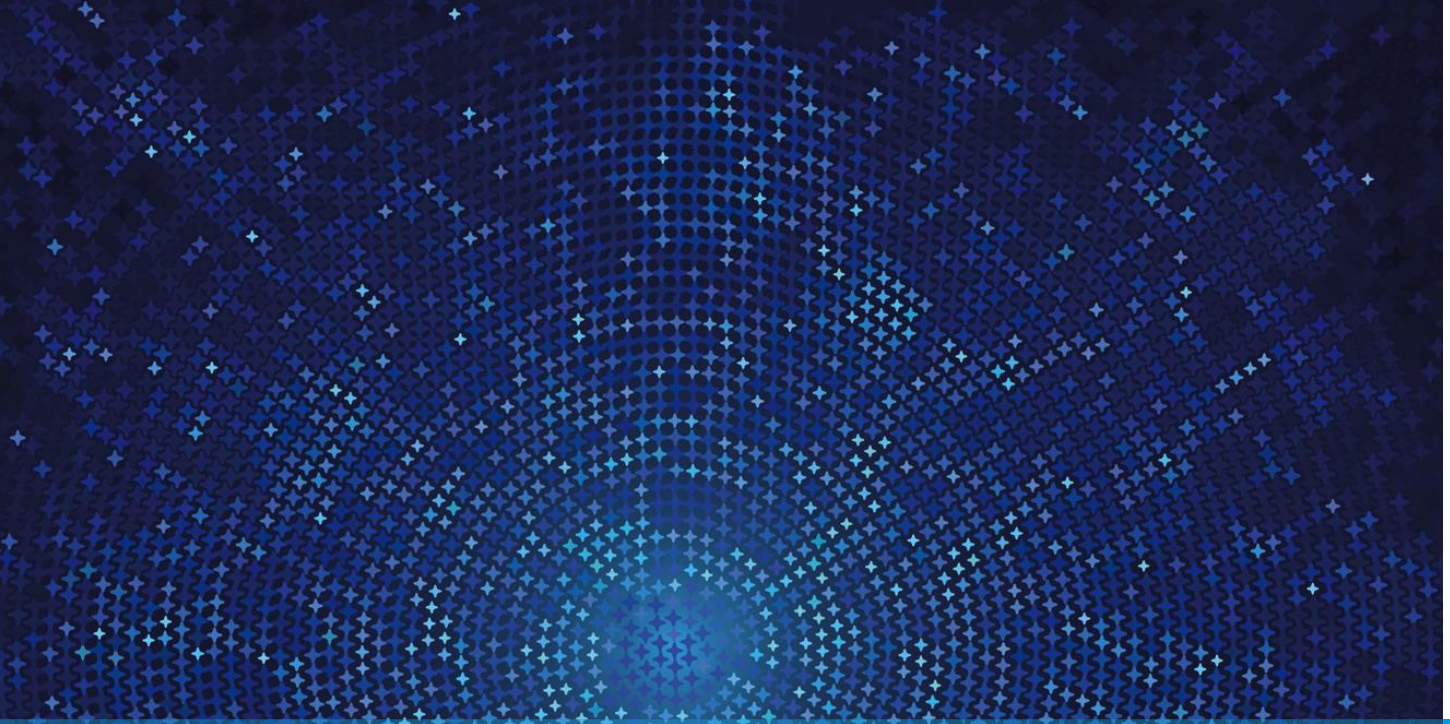
Plasma burner



Core temperature:
> 7000°C

Minimum temperature:
4000°C

Abatement efficiency:
> 99,9%



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SF_6 ReUse Process

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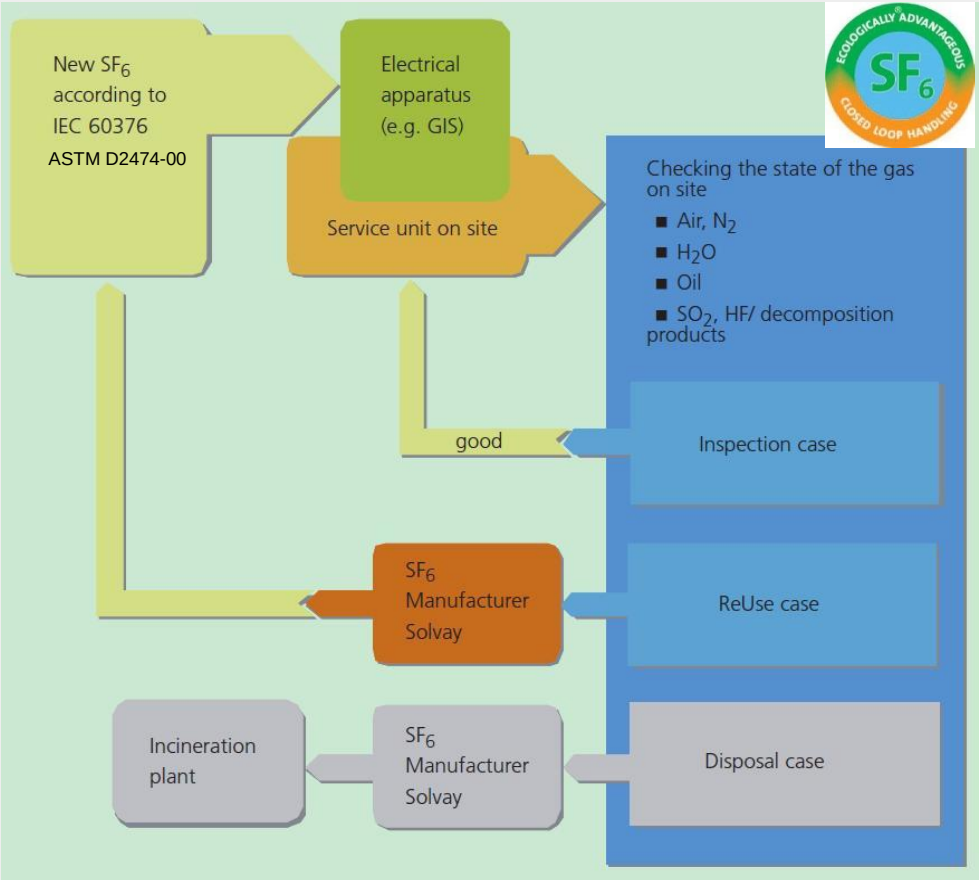
The SF_6 ReUse Process

- 3 Different Cases - quality dependent

A. Inspection Case

B. ReUse Case

C. Disposal Case



The SF_6 ReUse Process

Solvay ReUse services include

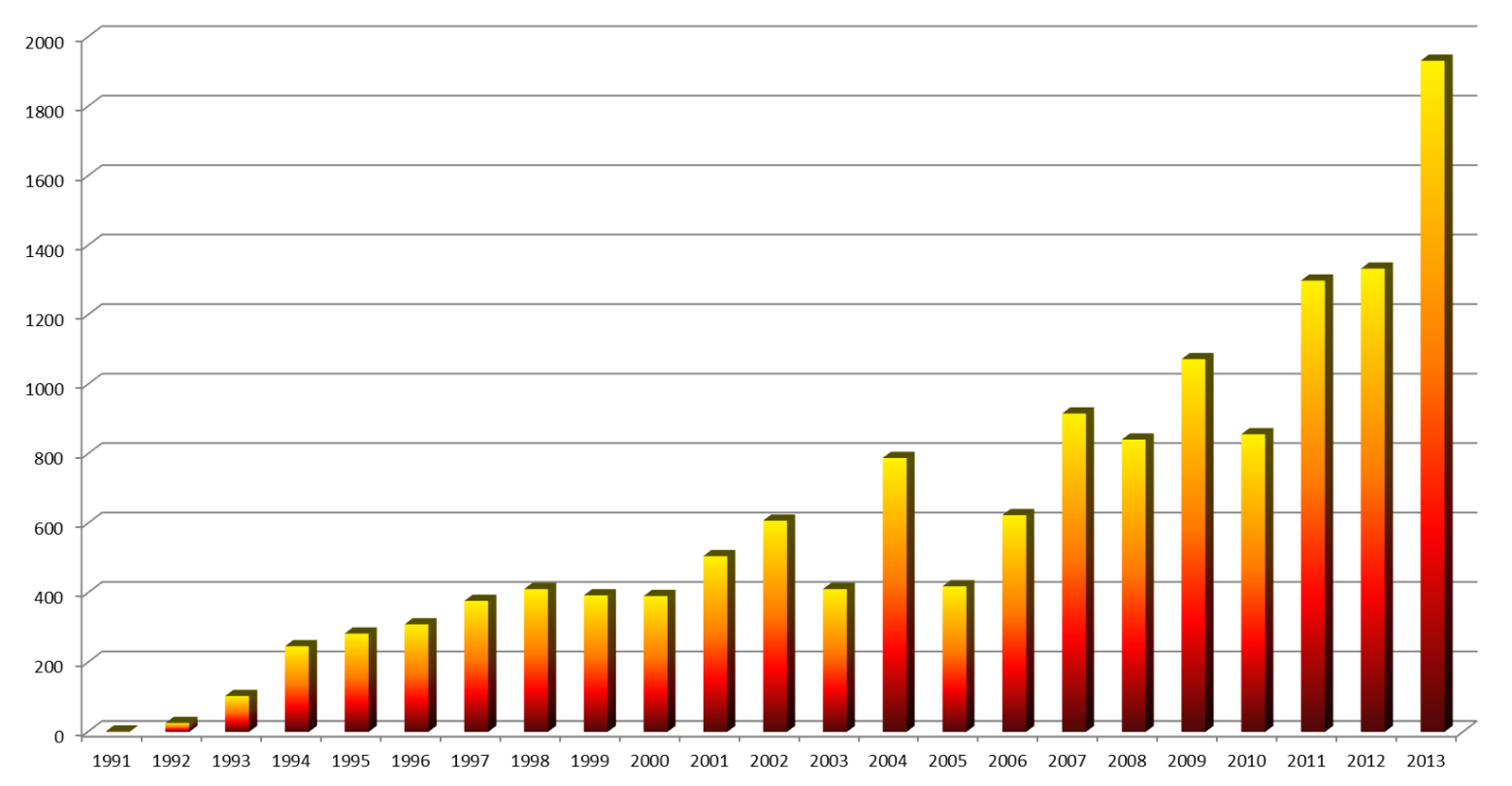
- Offering of special packaging for used/contaminated SF_6
- Transport arrangements
- Analysis of used SF_6
- Environmental friendly conversion of used SF_6 into new virgin product which meets all specification of virgin SF_6 ***including the non-toxic requirement.***
- Environmentally safe disposal in case the used SF_6 is too heavily contaminated (very rare case)

The SF_6 ReUse Process

The Closed Loop

SF_6 ReUse Process

Reprocessed SF_6 quantity related to the first amount in 1991 (%)



Due to the treatment of used SF_6 within Solvay's ReUse Process, emissions of more than 15 Mio t CO_2 equivalents could be avoided up to now. Almost all returned volumes can be re-processed into new virgin SF_6 and only a minor part must still be incinerated due to unacceptable contamination levels (in 2013 less than 1% of return material).

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Summary

SF_6 Emission Reduction

Summary

- Efforts to reduce SF_6 Emissions have to start already at the point of production
  - Not just emissions at the point of use matters
  - Every pound that is used might have already caused some emissions
  - SF_6 Emission reduction efforts of the manufacturers should be an integral and important part of the SF_6 purchase decision
- Solvay contributes in two ways to lower SF_6 emissions
  - Direct: strict control over process and filling
  - Indirect: ReUse program for your used SF_6
  - Impressive trends over the past years have been demonstrated

Thank you

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