

## SF6 Gas Emissions and Reclamation within the Electrical Industry

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“Measure 7.2 of the National Greenhouse Strategy calls for the development of environmental management strategies for synthetic gases through co-ordinated action by all jurisdictions in consultation with industry.

Attention has been focused on reducing emissions through improving the information on inventories of SF6 used in equipment, monitoring the amount of SF6 contained in equipment in service and leakage rates from equipment, improving seals and reducing leakage rates from new equipment, and recovery and recycling of contaminated SF6. Ontario Hydro noted that the simplest form of control is the development of handling procedures to minimise losses and their careful implementation by proper training to ensure the desired results are achieved.

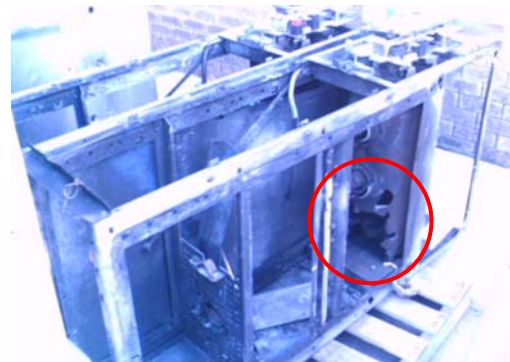
Original data on the amount of SF6 used in Australia, releases of SF6, and information on reclamation and recycling practices are not available.<sup>1</sup>

As a leading supplier of SF6 Insulated switchgear, Schneider Electric, in accordance with the Group's commitment to environmental responsibility, has worked closely with specialists and regulators within Australia to provide a safe, sound and cost-effective solution for our customers' equipment end of life needs. Engineered Services developed a process to document the transport and management of SF6 extraction from disused equipment at our Brisbane plant, and the final environmental destruction of the remaining switchgear, all within the guidelines of IEC and EPA requirements.

Schneider's market research suggests that tens of thousands of circuit breakers and RMU's in operation within Australia are at or near the end of their life cycle. Hundreds more are already lying in equipment “graveyards”, as utilities and owners, aware that usual disposal methods for disused switchgear are not environmentally acceptable for SF6 switchgear, consider their limited options.

During our first year of commercial operation of the reclamation service, anecdotal evidence of incidences of poor handling procedures, accidental emissions, continuous “topping up” of abnormally leaking equipment and therefore excessive SF6 emissions were much higher than we might have anticipated. It should be noted that this generally stems from a limited understanding of the appropriate processes and inadequate training available from the reclamation equipment suppliers.

Analysis of our reclamation efforts, showed that while substantial percentages of gas were able to be reclaimed and recycled from most equipment, many units were so badly damaged or leaking, that no SF6 remained within the enclosures, but had clearly been lost to the atmosphere.



*Typical SF6 Graveyard with damaged gas chamber*

In its 1998 report on SF6 emission methodology the US EPA stated, “EPA's estimate was based on information that emissions rates from this equipment were significant and atmospheric measurements that indicated that most of the SF6 produced internationally since the 1950s had been released. Emissions from electrical equipment were known to occur from the service and disposal of the equipment and leaks during operation. Leaks from older equipment were reported to release up to 50 percent of the equipment's charge per year, although leaks from newer equipment were reported to release considerably less (e.g., less than 1 percent of the charge per year).”<sup>2</sup> The conclusion drawn by the US EPA was that emission rates from equipment must be higher than had been claimed. It was assumed that equipment leaked at a rate much higher than proposed by industry.

<sup>1</sup> Synthetic Gas Use in Non-Montreal Protocol Industries, Australian Greenhouse Office, April 2000

<sup>2</sup> US Environmental Protection Agency: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–1998

Current thinking appears to be that SF6 emissions estimates from the Electrical Industry should be revised downwards, but our experience would suggest just the opposite, if the decommissioned equipment degradation is included in reporting methodologies.

As SF6 gas pressure is often critical to the correct operation of gas insulated switchgear and transformers, it is usually monitored with equipment in service.

Any mass balance approach must consider the much higher contributions of emissions from decommissioned equipment that is no longer monitored for gas loss as with equipment in service. These emissions far exceed any estimates of industry emissions percentages based on manufacturer's leakage rates (default loss rate 0.5%<sup>3</sup>). As with other pollutants, responsibility should rest with the owner of the equipment, regardless of its operational status, until such time as it has been appropriately reclaimed and recycled or destroyed and documented.

## **Training**

The ENA have already recognised that training is a key element in SF6 emissions reduction. Their SF6 Working Group policy states that "SF6 guidelines will specify objectives that companies minimise and monitor emissions and ensure that trained staff handle SF6".<sup>4</sup>

Safe Handling of SF6 is not only critical for OH&S reasons, but also integral to minimising emissions. The staff typically handling SF6 will be electrical technicians and trades persons, and not necessarily familiar with safe gas and cylinder handling techniques in general. Issues include line and system purging of air during filling and extraction, gas storage, transportation, pressure and temperature effects (SF6 boils at -63.8 deg C and 1013 mbar) and relevant regulations, as well as the environmental awareness. SF6 emissions may be small in relation to CO2 and other greenhouse gases, but with a GWP rating of 23,900 CO2e, and an atmospheric life of 3,200 years<sup>5</sup>

This training needs to be available through certified providers.

## **Emissions Trading**

At present, the Greenhouse Gas Abatement Program (GGAP) covers all greenhouse gases listed in the Kyoto Protocol with the exception of SF6.<sup>6</sup>

Prevention of SF6 gas entering the atmosphere from decommissioned and unmonitored apparatus should surely qualify as a Clean Development Mechanism, and therefore generate emissions credits. This would encourage the industry to review its equipment graveyards, and reduce dramatically the potential emissions.

It is suggested that such processes could be reviewed and certified as compliant to the emission reduction guidelines in order to lend confidence to the users.

Without wishing to doubt the good intentions of Environmental Managers in the industry or the green commitment of reputable organisations, discussing with potential customers their current practices or policies for SF6 equipment End of Life management, or even a need for training in industry best practices for SF6 gas handling is a delicate subject. Staff with operational responsibility recognise their duty of care, but need to balance this against operational demands.

Those that have been successful in their efforts to implement emission reduction strategies on all equipment still under their ownership should be rewarded.

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<sup>3</sup> AGO Factors and Methods Workbook, Department of the Environment and Heritage, December 2006

<sup>4</sup> ENA Policy Committee Structure Nov 2007 (provided at E21C conference, Sydney November 2007)

<sup>5</sup> IPCC: Climate Change 1995, The Science of Climate Change

<sup>6</sup> Australia's Fourth National Communication on Climate Change 2005, Dept of Environment and Heritage