HSS Office of Health, Safety and Security

# Safety Bulletin

# Sulfur Hexafluoride ($SF_6$) Awareness

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## PURPOSE

This bulletin provides information on the environmental and sustainable management of sulfur hexafluoride ($SF_6$) at DOE sites. $SF_6$ is an extremely potent greenhouse gas.

## BACKGROUND

Sulfur hexafluoride is a colorless, odorless, non-toxic synthetic gas commonly used to insulate electrical equipment. Equipment such as circuit breakers, current-interruption equipment, transmission lines, transformers, and substations account for over 80% of the annual use of $SF_6$ in the United States. Atmospheric emissions occur during equipment maintenance or leaks. In addition to electrical equipment, $SF_6$ may be intentionally released directly to the air in small amounts as a tracer compound for air dispersion studies.

## WHAT ARE THE HAZARDS?

An extremely potent greenhouse gas (GHG), the release of one metric ton (tonne) of $SF_6$ is equivalent to 23,900 tonnes of carbon dioxide ($CO_2$). Small releases, therefore, significantly contribute to site GHG emissions.

The material safety data sheet (MSDS) for $SF_6$ indicates that it is non-combustible and non-flammable. However, standard safety procedures for handling pressurized gas cylinders and equipment should be followed (see HSS Safety Bulletin 2007-01, http://www.hss.energy.gov/CSA/csp/safety_bulletins/SB_2007-01.pdf). In the event of fire, personnel should be evacuated and fire-fighters should wear self-contained breathing apparatus as $SF_6$ may create hazardous gases including disulfur decafluoride ($S_2F_{10}$).

## CONTROLLING HAZARDS THROUGH LIFECYCLE MANAGEMENT

Currently, there is no direct gaseous substitute for $SF_6$, so emission reductions require controlling releases. A lifecycle approach to $SF_6$ management, including a focus on tracking inventory, leak detection and repair, and proper disposition including recycling, is a recommended best practice.

A **tracking program** should include a complete inventory of $SF_6$ including purchases, on-site storage, equipment capacity (nameplate), and disbursements. Tracking practices include the following:

- Inventory of $SF_6$ cylinder locations from arrival to departure. Include the location of all equipment and storage areas where $SF_6$ is found. One cylinder (115 lbs. of $SF_6$) is the equivalent of 1,250 tonnes of $CO_2$.
- Use of $SF_6$ on-site, as equipment requiring frequent "topping-off" may need maintenance or replacement.
- Quantity of $SF_6$ consumed, as partially filled containers shipped offsite would otherwise be assumed full.

**Leak detection** is essential to minimizing releases. According to EPA, 10% of circuit breakers leak and 15% of these are readily repairable. The majority of leaks occur at gas mechanisms, bushings, and gas tanks.

Assess usage and inventory data to identify equipment that may be leaking. Maintenance and replacement can be prioritized according to the severity of leaks.

Leak identification can be aided by low-gas density alarms, handheld halogen detectors, and laser cameras. Detection techniques include spraying non-electrical or de-energized equipment with a solution of soap and water and use of microprocessor density monitors on equipment.

**Proper disposition including recycling** will reduce atmospheric emissions. During maintenance, evacuate $SF_6$ into portable cylinders instead of venting to the atmosphere. Recaptured $SF_6$ can be re-used on-site or shipped to a recycler. Both air and water can degrade the purity of $SF_6$ and are not easily removed. An on-site $SF_6$ recapture and reuse program requires the following:

- Coverage under the site health and safety program,
- Resources and procedures to recover, store, and test the purity of $SF_6$ for on-site reuse,
- A minimum acceptable purity standard for $SF_6$ on-site reuse, and
- Disposition to an authorized $SF_6$ dealer/recycler if $SF_6$ is not reusable on-site.

## ADDITIONAL SOURCES OF INFORMATION

Contact your site Environmental, Safety, and Health staff or Jeff Eagan at 202-586-4598 or jeff.eagan@hq.doe.gov.

## SUMMARY

SF6 is a potent GHG. SF6 emissions can be reduced through tracking, leak detection, maintenance, and recycling.

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# PREVENT EVENTS

## Learning from Industry Experience

**PREVENT EVENTS is intended for use by personnel during morning meetings, pre-job briefings, and work unit meetings to communicate key industry experience.**

**Management:**

1. Is there an inventory of $SF_6$ containing equipment?
2. Have we developed statistical survey methods and plans to assess suspect equipment for $SF_6$ releases?
3. Are our procurement and chemical inventory tracking systems setup to help minimize the size and quantity of pressurized $SF_6$ cylinders at our site?
4. Are our environment, safety and health people keeping our utilities and facilities management people informed of the latest developments in environmental sustainable management of $SF_6$?
5. What training have we provided our workers on the characterization of $SF_6$-containing equipment and reporting of $SF_6$ releases?
6. What environment, safety and health programs are required to institute a recovery and reuse program for $SF_6$?
7. Have we calculated the impact of $SF_6$ on our site GHG inventory?
8. Are we tracking SF6 disposition practices?

**Supervisors and Workers:**

1. Have all employees for the job been properly trained to identify $SF_6$ leaks from electrical equipment?
2. What should we do with leaking cylinders or equipment?
3. Have employees for the job been trained on recovery and reuse procedures for $SF_6$?
4. What is the minimum acceptable purity standard for $SF_6$ in the equipment?
5. Does the facility have resources to recover, store, and test the purity of $SF_6$, or will a specialty contractor be required?
6. Are there special equipment or control measures to minimize accidental release of $SF_6$during evacuation?
7. How much vacuum must be generated for $SF_6$ recovery? Does the manufacturer specify evacuation procedures?
8. Is an oil compressor required for reclamation, or can an oil-less compressor be used to avoid contamination?
9. Are $SF_6$ disposition practices clearly defined and appropriate to minimize releases?