

Managing Your SF₆ Gas Inventory

***SF₆ Emission Reduction Partnership
Webcast
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Agenda

- Live Meeting Housekeeping Items
- Introduction - Why SF₆ Inventory Tracking is Important
- How Your Gas Supplier(s) Can Assist in SF₆ Gas Inventory Management
- Survey
- Questions and Discussion

Live Meeting Housekeeping Items

- Please mute your phone
 - No mute button? Enter *6 on your keypad to mute, *7 to un-mute
- Full Screen mode (F5)
- Q&A session at end of presentation
 - Interactive panels – bottom of console, enter a question or ask!

Why is Inventory Tracking Important?

- A better managed inventory:
 - Prevents over-stocking of unwanted “full” or “empty” cylinders
 - Can reduce cylinder rental fee charges and allow utilities to obtain credit on any unused gas remaining in the cylinder when returned to the vendor
 - Can help identify equipment requiring excess “top-ups,” which may be indicative of mechanical or structural problems that could be expensive and disrupt your system
- Provides the input needed to accurately estimate SF₆ emissions for corporate greenhouse gas inventories and EPA reporting



Estimating SF₆ Emissions Relies on Inventory Tracking

- Mass Balance method - unaccounted for SF₆ assumed emitted
- *Annual* tracking of SF₆ usage in the utility
- 4 Major Input Components
 - Change in Storage Inventory; Purchases/Acquisitions; Sales/Disbursements, Change in Name Plate (NP) capacity
- 2 Output Components
 - Total Emissions; Emission Rate
NOT source of emissions!

Inputs:

A. SF₆ Storage Inventory Levels in cylinders and gas carts at the beginning and end of the year

B. Purchases/Acquisitions of SF₆

C. Sales/Disbursements

D. SF₆ Nameplate Capacity of Equipment (Full and proper charge)

Change in Inventory (SF ₆ contained in cylinders, <u>not</u> electrical equipment)	Inventory (in cylinders, <u>not</u> equipment)
	1. Beginning of Year
	2. End of Year
	A. Change in Inventory (1 - 2)
Purchases/Acquisitions of SF₆	3. SF ₆ purchased from producers or distributors in cylinders
	4. SF ₆ provided by equipment manufacturers with/inside equipment
	5. SF ₆ returned to the site after off-site recycling
	B. Total Purchases/Acquisitions (3+4+5)
Sales/Disbursements of SF₆	6. Sales of SF ₆ to other entities, including gas left in equipment that is sold
	7. Returns of SF ₆ to supplier
	8. SF ₆ sent to destruction facilities
	9. SF ₆ sent off-site for recycling
	C. Total Sales/ Disbursements (6+7+8+9)
Change in Nameplate Capacity	10. Total nameplate capacity (proper full charge) of <u>new</u> equipment
	11. Total nameplate capacity (proper full charge) of <u>retired</u> or <u>sold</u> equipment
	D. Change in Capacity (10 - 11)

SF₆ Emission Inventory Reporting Protocol

- A description of the inputs, outputs, and the mass-balance method for estimating SF₆ emissions
- Accompanies the reporting form (first worksheet tab of the Microsoft Excel file)

This worksheet is based on the mass-balance method. The mass-balance method works by tracking and systematically accounting for all company uses of SF₆ during the reporting year. The quantity of SF₆ that cannot be accounted for is then assumed to have been emitted to the atmosphere. The method has four subcalculations (A-D), a final total (E), and an optional emission rate calculation (F) as follows:

- A. Change in Inventory.** This is the difference between the quantity of SF₆ in storage at the beginning of the year and the quantity in storage at the end of the year. The "quantity in storage" includes SF₆ gas contained in cylinders (such as 115-pound storage cylinders), gas carts, and other storage containers. It does not refer to SF₆ gas held in operating equipment. The change in inventory will be negative if the quantity of SF₆ in storage increases over the course of the year.
- B. Purchases/Acquisitions of SF₆.** This is the sum of all the SF₆ acquired from other entities during the year either in storage containers or in equipment.
- C. Sales/Disbursements of SF₆.** This is the sum of all the SF₆ sold or otherwise disbursed to other entities during the year either in storage containers or in equipment.
- D. Change in Total Nameplate Capacity of Equipment.** This is the net increase in the total volume of SF₆-using equipment during the year. Note that "total nameplate capacity" refers to the full and proper charge of the equipment rather than to the actual charge, which may reflect leakage. This term accounts for the fact that if new equipment is purchased, the SF₆ that is used to charge that new equipment should not be counted as an emission. On the other hand, it also accounts for the fact that if the amount of SF₆ recovered from retiring equipment is less than the nameplate capacity, then the difference between the nameplate capacity and the recovered amount has been emitted. This quantity will be negative if the retiring equipment has a total nameplate capacity larger than the total nameplate capacity of the new equipment.
- E. Total Annual Emissions.** This is the total amount of SF₆ emitted over the course of the year, based on the information provided above. The amount is presented both in pounds of SF₆ and in metric tons of CO₂-equivalent, that is, the quantity of carbon dioxide emissions that would have the same impact on the climate as the quantity of SF₆ emitted. Because SF₆ has 23,900 times the ability of carbon dioxide to trap heat in the atmosphere on a pound-for-pound basis, 1 pound of SF₆ is equivalent to nearly 11 tons of carbon dioxide.
- F. Emission Rate (optional).** By providing the total nameplate capacity of all the electrical equipment in your facility at the end of the year, you can obtain an estimate of the emission rate of your facility's equipment (in percent per year). The emission rate is equal to the total annual emissions divided by the total nameplate capacity.

Complete the form on the following page to estimate annual emissions. Use the comments box to describe the means used to obtain a specific quantitative value, e.g., measured, estimated using rough data, or other comments including perceived accuracy of the form entries. If there is not enough room in the tables to record all your comments, please attach additional sheets.

How can your gas supplier assist
your utility with managing your
SF₆ gas inventory?



A. Change in Inventory

- Partner must track **storage** inventory
 - Determine total storage inventory (i.e., any gas in cylinders and gas carts) twice a year
 - Electronic systems useful in tracking
 - SF₆ suppliers may be able to help

Change in Inventory (SF ₆ contained in cylinders, <u>not</u> electrical equipment)	Inventory (in cylinders, <u>not</u> equipment)		
	1. Beginning of Year		
	2. End of Year		
	A. Change in Inventory (1 - 2)		

B. Purchases/Acquisitions of SF₆

- Partner must account for gas purchases
 - Virgin gas purchased from suppliers
 - Gas provided by equipment manufacturers in equipment
 - Gas returned to site after off-site recycling

**Purchases/
Acquisitions
of SF₆**

3. SF₆ purchased from
producers or distributors in cylinders

4. SF₆ provided by equipment
manufacturers with/inside equipment

5. SF₆ returned to the site after
off-site recycling

B. Total Purchases/Acquisitions (3+4+5)

Gas Purchases from Supplier

- Large cylinders vs. small cylinders
- Cylinder delivery
 - Minimize “touch” labor
 - Minimize cylinder inventories
 - Maximize gas utilization
- Cylinder filling procedures
 - Vent and refill
 - Residual Pressure Valves



C. Sales/Disbursements of SF₆

- Partner must account for gas disbursements
 - **Gas returned to supplier**
 - Gas sent to destruction facilities
 - Gas sent off-site for recycling

Sales/ Disbursements of SF ₆	6. Sales of SF ₆ to other entities, including gas left in equipment that is sold		
	7. Returns of SF ₆ to supplier		
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	9. SF ₆ sent off-site for recycling		
	C. Total Sales / Disbursements (6+7+8+9)		

Gas Returned to Supplier

- Average product returned as residual in cylinder ~ 12%
- Standard cylinder contains 115 lbs when full: 12% residual = 13.8 lbs/cylinder
- Example: Partner purchases 150 cylinders/year of virgin SF₆: residual product returned to supplier = 2,070 lbs

Gas Returned to Supplier

- Returned cylinders must be weighed to quantify residual product
- Gas supplier can provide this service and supply detailed monthly spreadsheet with exact residual gas amounts returned
- Utility Partner can utilize these reports when completing annual program report

Benefits to Utility Partner

- Utility may obtain partial credit on any unused gas remaining in cylinders when returned to the vendor
- Work required for quantification of residual product is done by supplier
- **Accurate reporting to EPA – residual product will not be counted as emissions!**

Survey

- ___ My company already uses our SF₆ supplier to help track inventory.**
- ___ I plan on asking our SF₆ supplier to help track inventory.**
- ___ My company tracks inventory without the help of the SF₆ supplier and finds this method adequate.**



Thank you.

- **Questions, Discussion, Feedback**

Closing Survey

We want to hear from you! Select the topic for our next SF₆ Tech Session Webcast:

SF₆ Recycling

SF₆ Leak Detection

**SF₆ Leak Measuring Methods
(monitoring systems)**

SF₆ Equipment Repair