A Refresher on Calculating SF_6 Emissions Using the Mass-Balance Approach

Paul Stewart

ICF International

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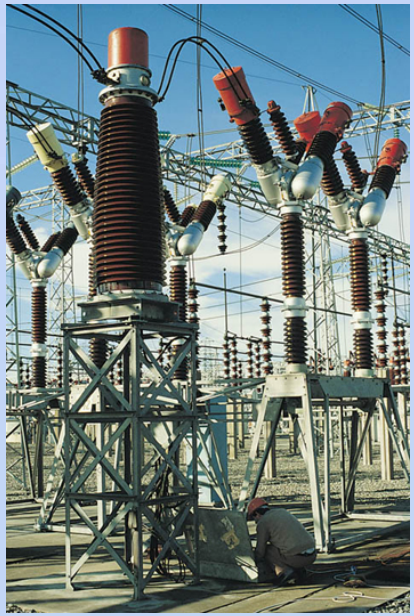


Purpose of the Presentation

- Review fundamentals of the mass-balance so the approach will be fresh in our minds for later discussions
- Present methods to develop more accurate mass balance inputs and therefore more accurate SF_6 emission estimates
- Discuss challenging issues regarding mass-balance to encourage critical thinking and information sharing

Overview

- Understanding the Inputs of the Mass-Balance Formula
- Common Issues Encountered with the Mass-Balance Approach
- Other not so common issues

Inputs to the Mass-Balance Formula

Understanding Mass-Balance Formula Inputs

- Understanding relationship among all inputs is important for getting the concept of the mass-balance formula
- Think about section B first
  - Purchases and acquisitions. Represents all gas brought onto system through external sources
- Then, section A
  - Inventory change. Tells us whether the amount of gas purchased and acquired in section B was more or less than the system required for that year.
- Sum of section A and B = total amount of gas that potentially could have been emitted

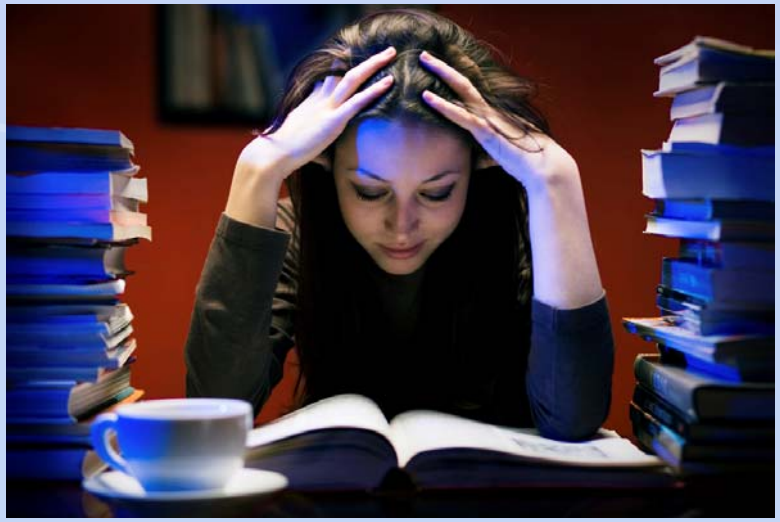
Understanding Mass-Balance Formula Inputs

- However, before assuming that all gas was emitted, must consider the non-emission routes that gas could have taken when leaving system
  - Was it sent off-site (section C – sales and disbursements)?
  - Was it used to fill new equipment (section D – new nameplate capacity)?
- Not sent off-site or used to fill new equipment

  → it must have been emitted!

Common Issues Encountered with the Mass-Balance Approach

- The arithmetic and concept of the mass-balance is the easy part.
- Getting each input exactly correct can be more challenging.



Common Issues Encountered with the Mass-Balance Approach

Issue #1. Beginning of year SF_6 storage inventory does not equal end of year SF_6 storage inventory?

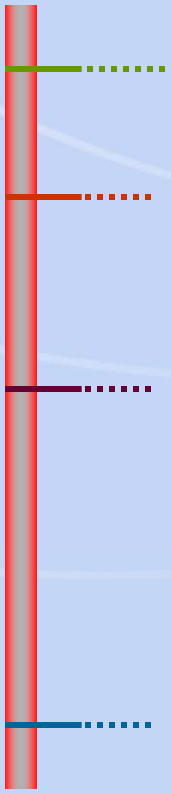
Issue #2. B4 and D10 relationship

Issue #3. Accurate SF_6 Nameplate Capacity Estimation for System

Issue #1. Beginning of year inventory does not equal end of year inventory?

- EOY for a given year MUST equal BOY for following year.
- EOY inventory value must reflect inventory on January 1 or emissions might be attributed to incorrect reporting year.
- For example, consider the hypothetical scenario shown on the next page

Issue #1. Beginning of year inventory does not equal end of year inventory?



December 15, 2010 — End of year 2010/beginning of year 2011 inventory is determined

December 20, 2010 — Major leak occurs at GIS station, gas pulled from inventory

January 1, 2011 — Happy New Year!

December 15, 2011 — End of year 2011/Beginning of year 2012 inventory is determined

SF_6 taken out of storage inventory to service the December 20, 2010 leak is not registered until 2011 end of year calculation.

Issue #2. B4 and D10 relationship

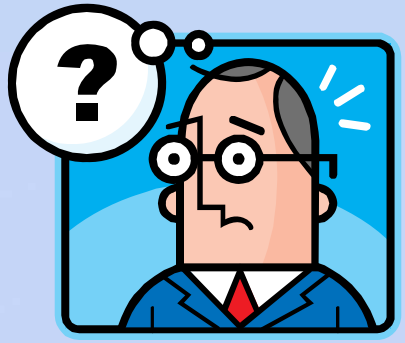
- B4 = SF_6 provided by equipment manufacturers with/inside equipment
- D10 = new nameplate capacity
- B4 must be inclusive of all SF_6 received with or inside equipment
  - –including gas received from the OEM in cylinders **alongside** the equipment AND
  - –gas that is contained **inside** the equipment for shipping purposes.

Issue #2. B4 and D10 relationship (cont.)

- Hence, it is not appropriate to simply copy the value for D10 into B4 or vice-versa.
- Just because a utility chooses to obtain all bulk SF_6 gas from gas distributors does not automatically mean that B4 is 0.

Issue #3. Accurate SF_6 nameplate capacity of system

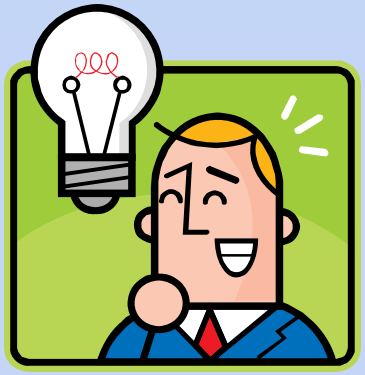
- Repairs and upgrades can alter internal structure of equipment
- Labeling can be imprecise or non-existent, especially for old equipment and switches



- Utilities might not have tracked nameplate capacity carefully in the past
  - It is labeled as an optional reporting parameter for EPA's voluntary Partnership
- Very important parameter for tracking progress in SF_6 management

Issue #3. Accurate SF_6 nameplate capacity of system (cont.)

- Steps for improving nameplate estimation:
  - Keep records of how much gas equipment actually holds and whether this amount differs from the amount stated by the OEM



  - If major repairs or alterations occur on the equipment, consider the corresponding changes in nameplate capacity
  - Communicate with OEMs to determine nameplate capacity of existing and new equipment, if information is not already available

Other Not So Common Issues

- Treatment of SF_6-containing circuit breakers on-site but not yet commissioned and accompanying cylinders which will eventually be used to fill the breakers when they are put into service (installation scheduled over the course of 3 years).

- What other unique situations are you encountering?

Questions, Comments, Discussion

Thank you for your attention

Paul Stewart

ICF International

1-202-862-1135

pstewart@icfi.com