EPA/NEMA Working Group: Estimating Nameplate Capacity

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Introduction

- **This presentation will address:**
  - EPA and Electric T&D SF_6 Coalition (NEMA) Working Group
  - Nameplate Capacity Discrepancies
  - GHGRP Reporting Implications
  - Draft Guidance
    - *Preventative Measures*
    - *Measures for Addressing Discrepancies*
  - Next Steps

EPA/NEMA Nameplate Capacity Working Group

- **Working Group comprised of approximately a dozen stakeholders**
  - Members of NEMA's Electric T&D SF_6 Coalition, Partner utilities, Original Equipment Manufacturers (OEMs), federal and state government representatives, and service providers

- **Goals**
  1. To collaborate among all relevant stakeholders to reach a common understanding of the issues with nameplate capacity
  2. To identify practical solutions that ensure consistency and accuracy in determining and applying nameplate capacity in estimating SF_6 emissions

Nameplate Capacity Discrepancies

- ***Nameplate Capacity***
  - Required data reporting element under both subparts DD and SS of the 40 CFR Part 98.
  - "the full and proper charge of equipment rather than the actual charge, which may reflect leakage." §98.303(a)
- ***"Stated" Nameplate Capacity***
  - The nameplate capacity value, in pounds, stated either on a label on the GIE and/or by the manufacturer's specifications.
  - Determined by the equipment manufacturer when the equipment was manufactured.

Nameplate Capacity Discrepancies

- **Newer GIE**
  - "Underfilling" - filling to a density which results in a mass, in pounds, that is lower than the stated nameplate capacity.
  - "Overfilling" - filling to a density which results in a mass, in pounds, that is higher than the stated nameplate capacity.
- **Older GIE**
  - Both values can be unknown or inaccurate
  - Leaks
- **Stated Nameplate Capacity ≠ Nameplate Capacity**
  - The primary concern is not which of the two values is accurate but the inconsistency that is introduced when using the stated nameplate capacity to estimate emissions in cases when it differs from the actual charged quantity in the equipment.
  - The emission estimate will be skewed; phantom emissions, hidden emissions, and even negative emission errors can occur.

Why is Nameplate Capacity Discrepancy a concern?

- **Accurate emissions estimates**
  - Mass balance equation
  - Magnitude of problem
- **Regulatory compliance**
  - US EPA's GHGRP reporting threshold
  - California and Massachusetts emissions standards

Mass Balance Equations & Nameplate Capacity

- **Subpart DD – Eq. DD-1**

User Emissions = (Decrease in Storage Inventory) + (Acquisitions) – (Disbursements) – (Net increase in Total Nameplate Capacity of Equipment Operated)

The net change of nameplate capacity is determined by taking the nameplate capacity of new equipment and subtracting the nameplate capacity of retiring equipment

- **Subpart SS – Eq. SS-6**

Emissions from Equipment Installation = (Total Mass used to Fill Equipment) + (Total Mass used to charge Equipment Prior to Leaving the Manufacturer Facility) – (Total Nameplate Capacity Installed at Electric T&D Facility)

GHGRP Reporting Implications

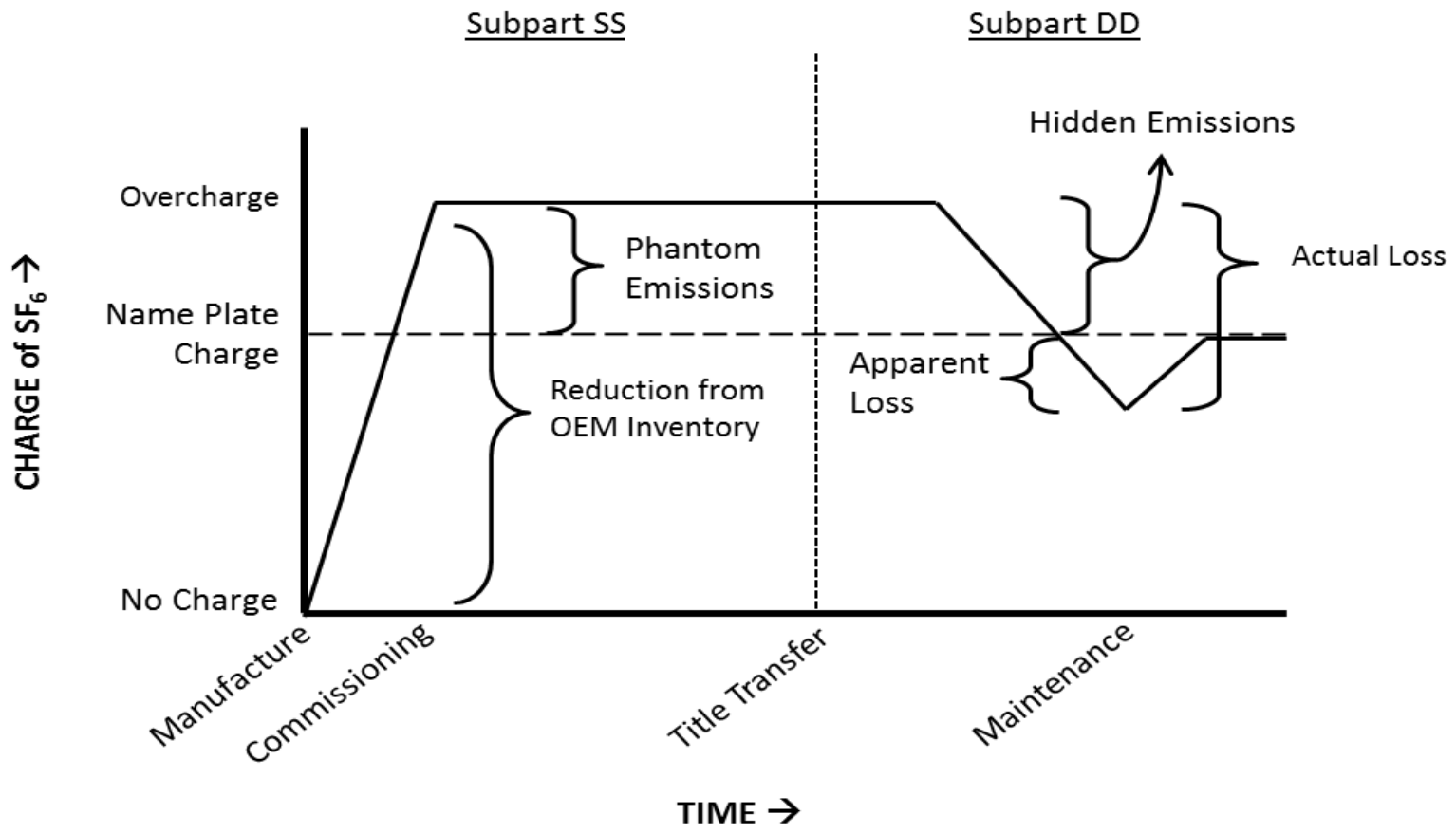
- Nameplate capacity discrepancies can not only shift the reporting of emissions from one point in time to another, but they can also shift the burden of reporting. Theoretically, they could balance out over time or over large sets of equipment.

Some Terms

- **Phantom Emissions** – an overestimate of emissions; emissions that did not actually occur
- **Hidden Emissions** – an underestimate of emissions; emissions that occurred but cannot be measured
- **Negative Emissions** – an error in the calculated emission estimate related to an inaccuracy of excess gas in equipment or storage inventory

Illustration of an Overcharge Scenario

Figure 1A: Phantom and Hidden Emissions after Leakage below Nameplate and Maintenance – OEM Overcharge



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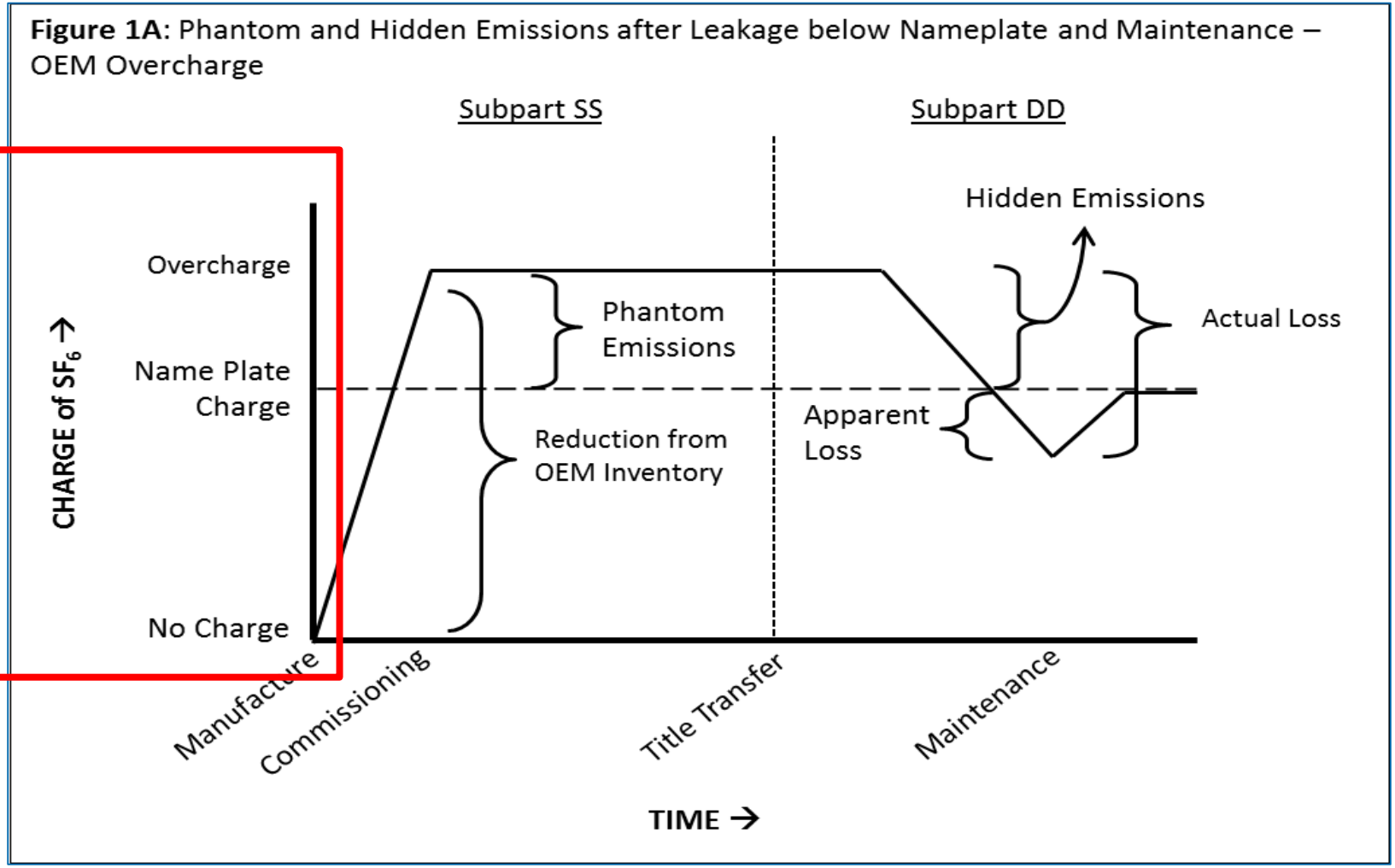

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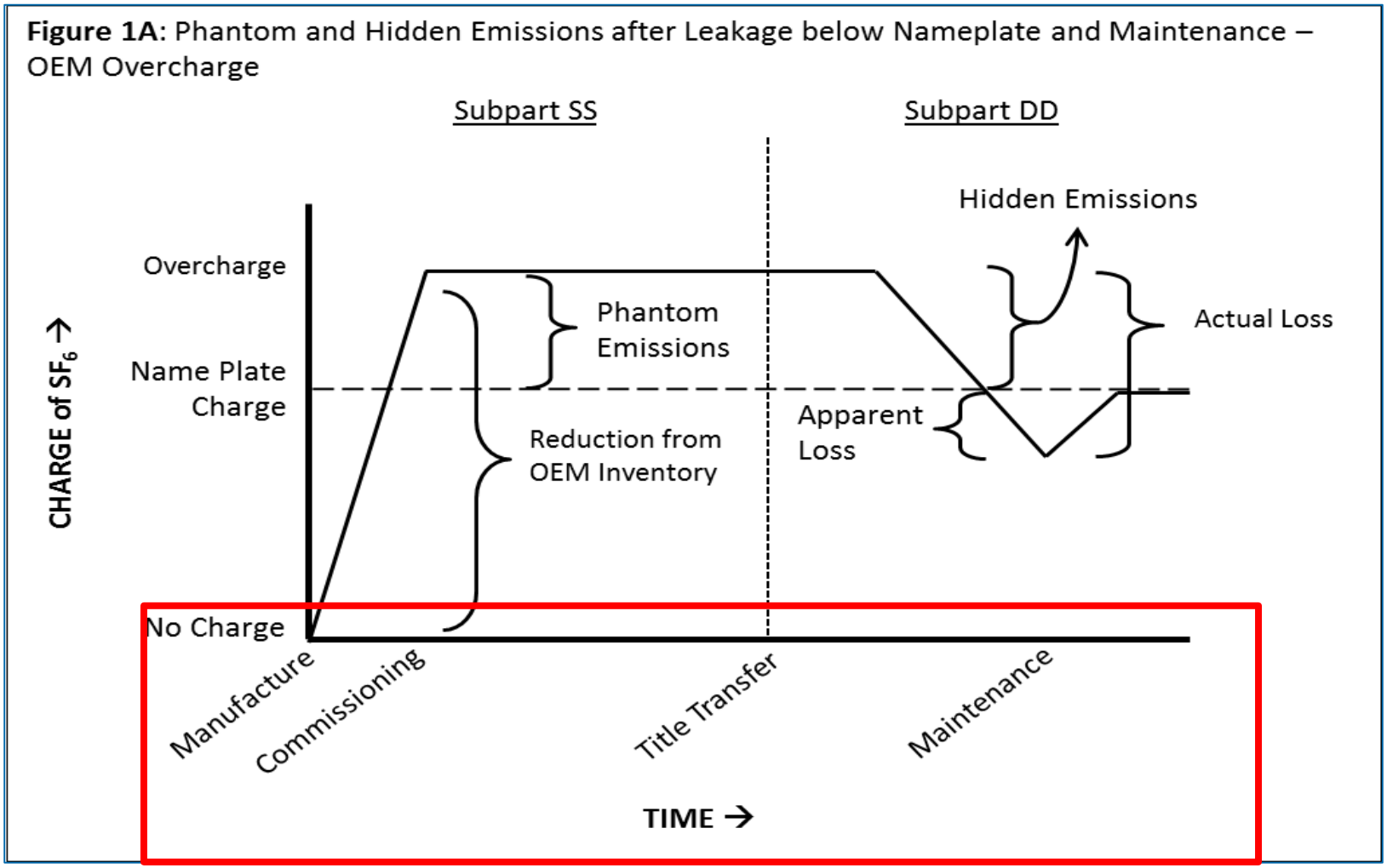

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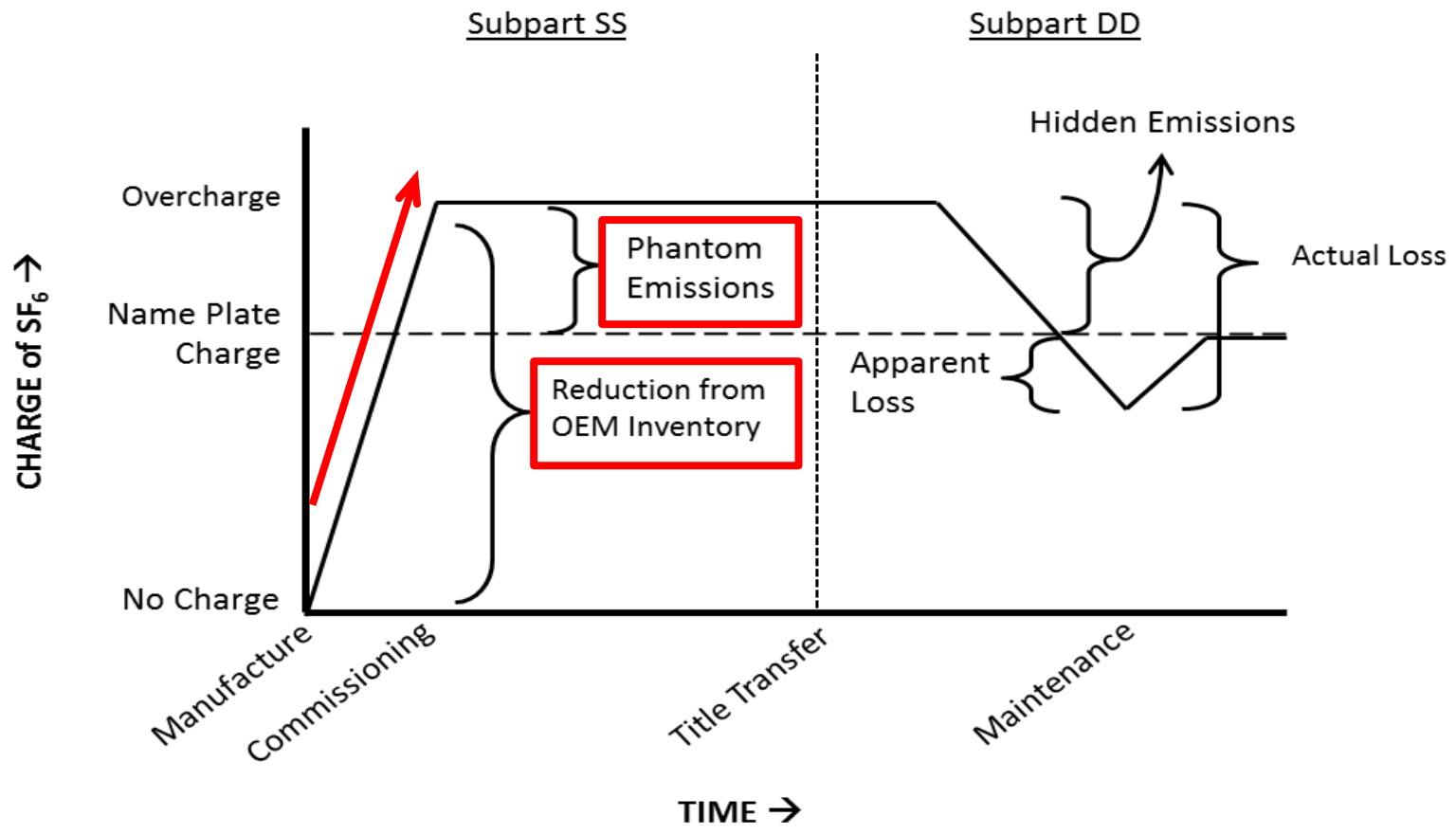

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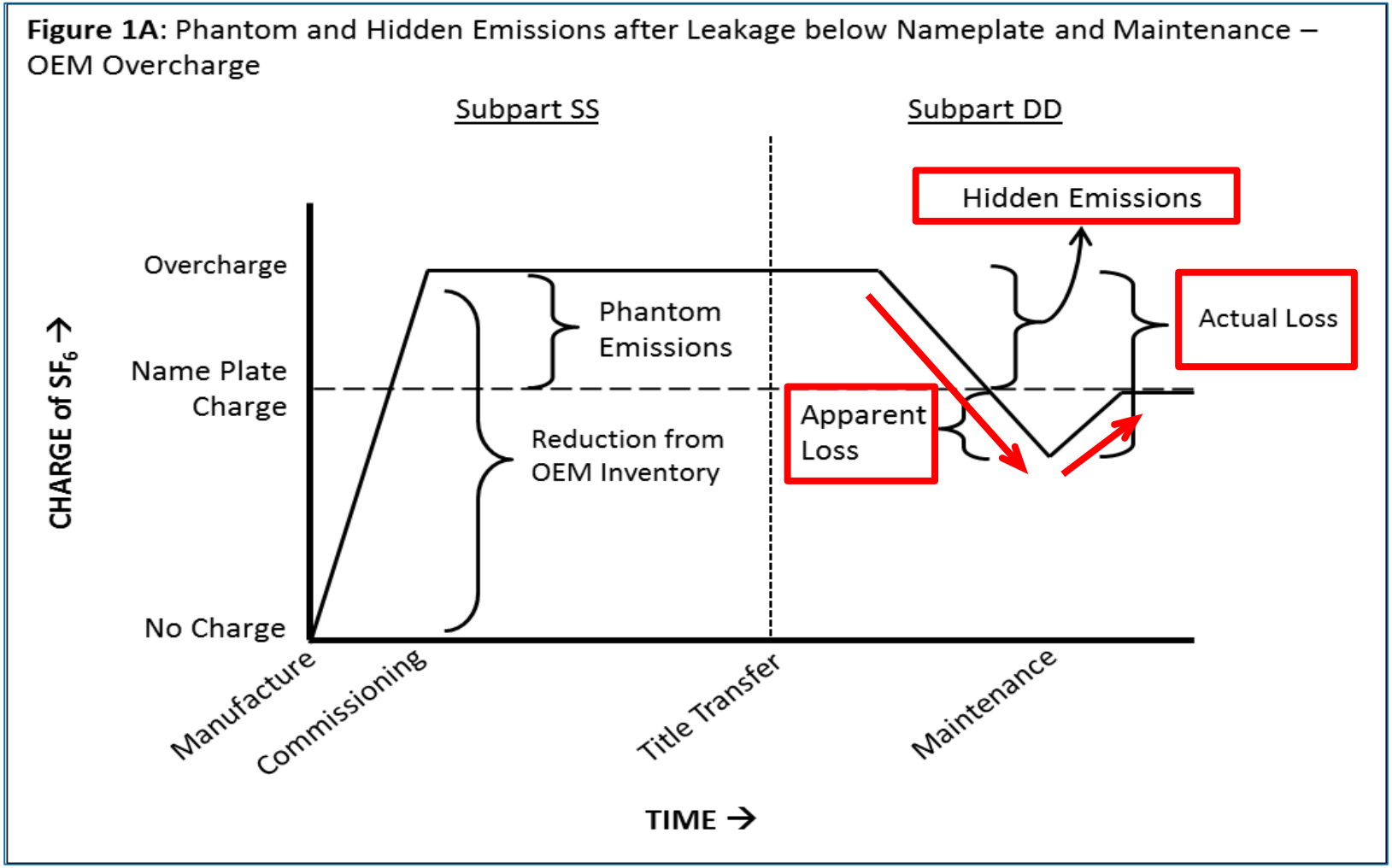

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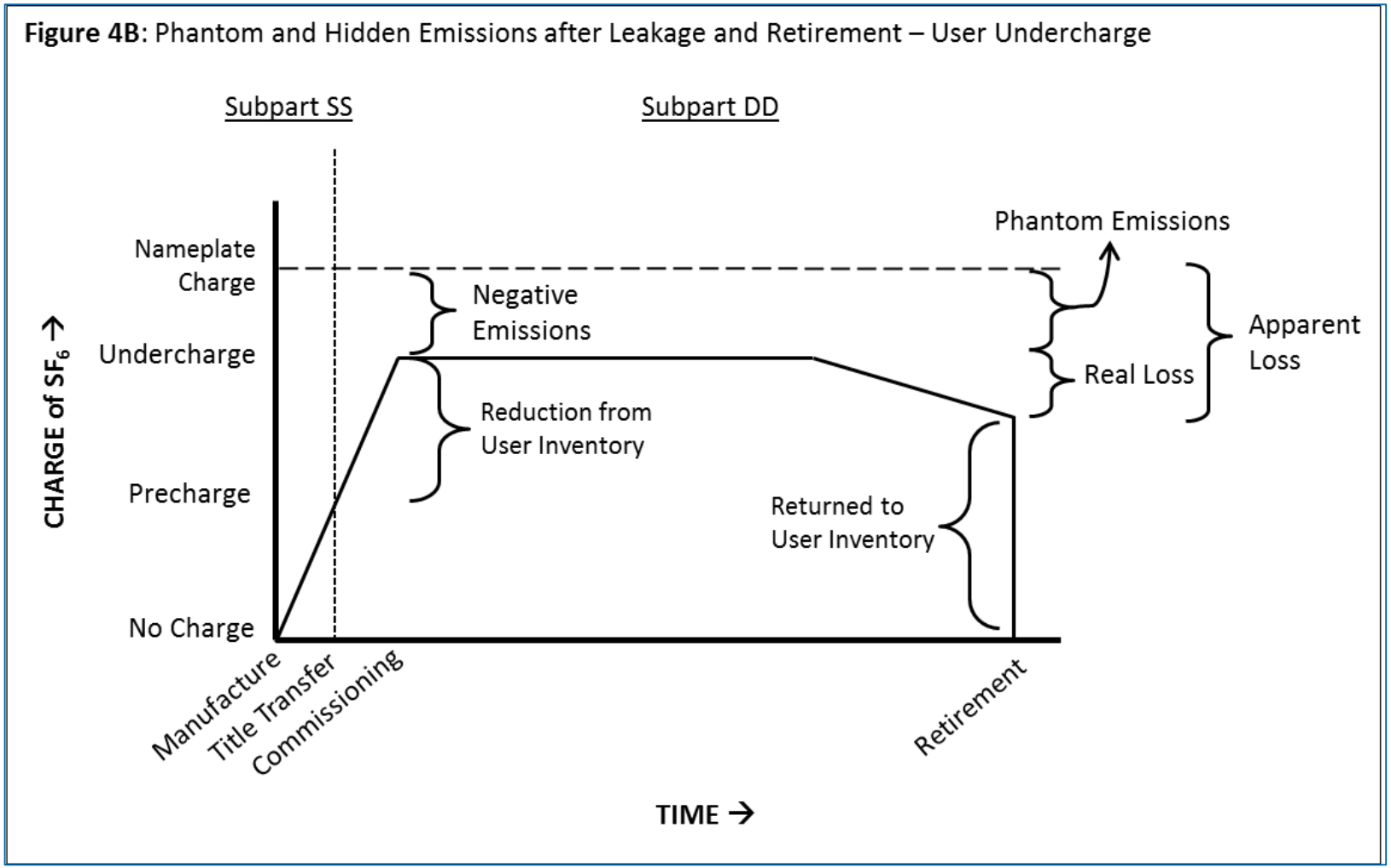

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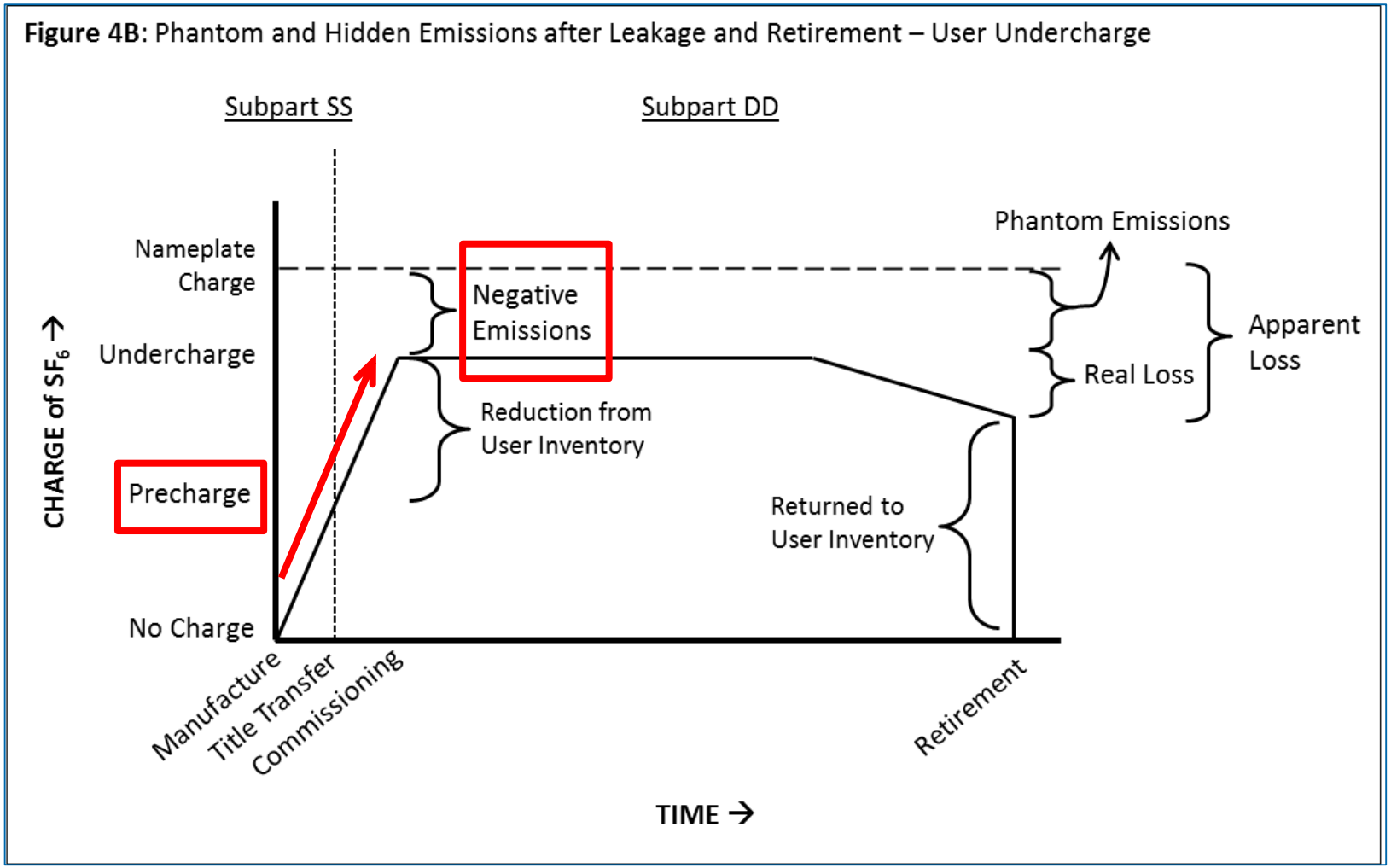

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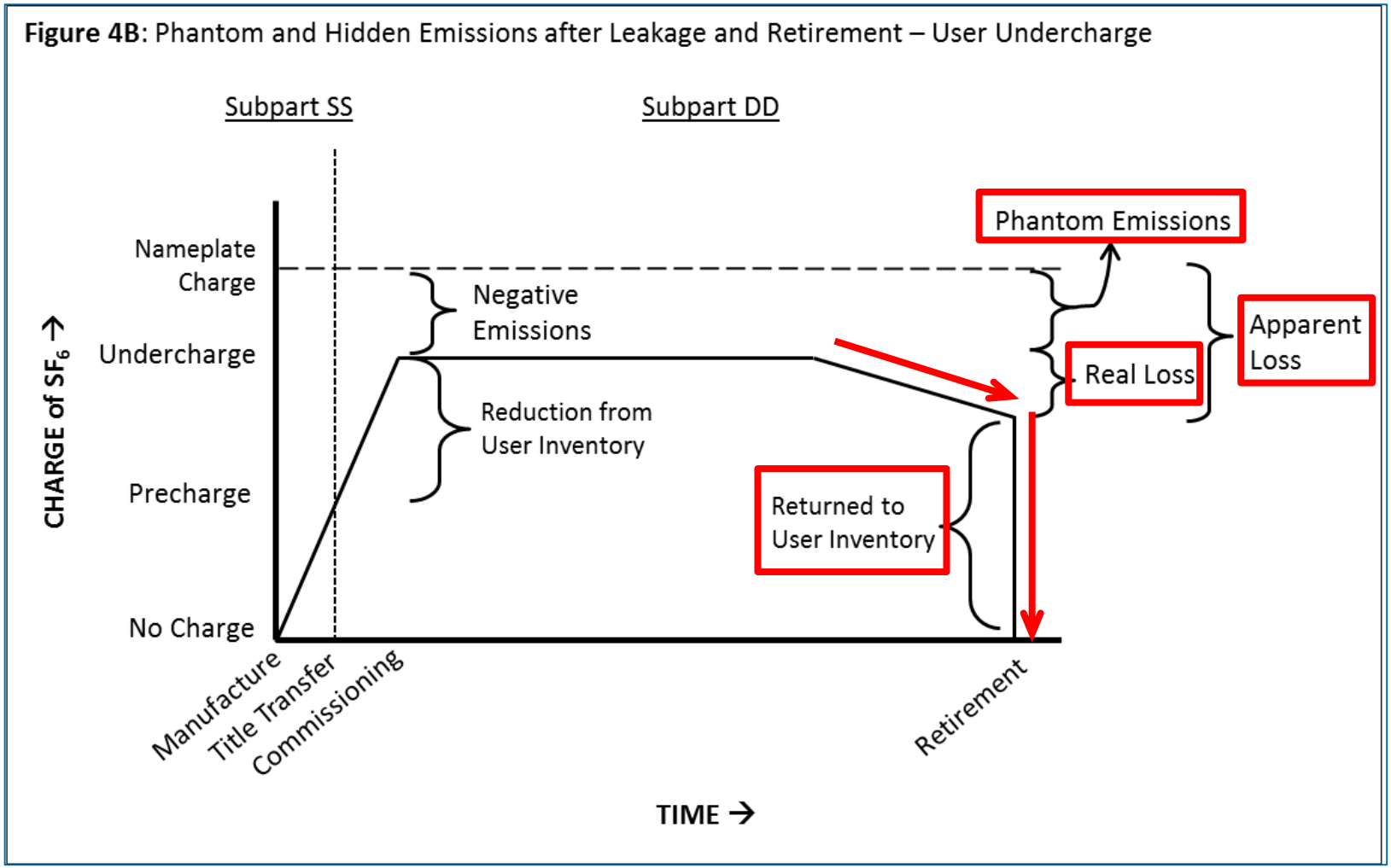

Accuracy & Consistency across GIE Life Stages

Manufacture	Installation	Service	Decommission
Stated vs. Actual NPC Partial Pressure Gauge Type and Quality	Partial pressure from OEM Overfilling and Underfilling Phantom emissions Negative emissions	Overfill Cylinder weighed in field or end of year Gauge performance	Hidden emissions Negative emissions Phantom emissions

Nameplate Capacity Draft Guidance

- **Purpose**
  - Practical guidelines and best practices of preventing and addressing inconsistencies
- **Draft Guidance provides**:
  - Preventative measures to avoid discrepancies at each GIE life stage
    - *Manufacture*
    - *Installation*
    - *Servicing*
    - *Refurbishment*
    - *Decommissioning*
  - Measures for addressing discrepancies when they are identified in Installed Equipment
- Current Draft work in progress and not yet vetted by industry or adopted by EPA.

Preventative Measures
Manufacture

- **Clearly communicate and document values, including:**
  - stated nameplate capacity,
  - pre-charge quantity contained in the GIE when shipped, and
  - actual quantity that represents a full charge (should that quantity differ from the stated nameplate capacity).

- **Keep records**
  - EPA's regulation requires facilities to keep records of the data used to calculate the GHG emissions for each unit, operation, process, and activity.
    - *This includes the measurements and calculations used to determine nameplate capacity.*
  - OEMs must keep in their records all certifications of the quantity of gas, in pounds, charged into equipment at the electrical equipment manufacturer or refurbishment facility as well as charged into equipment at installation (Part 98 Section 98.457(c)).

Preventative Measures
Installation

- **Discontinue overfilling and underfilling**
  - Discontinue the practice of knowingly overfilling or underfilling to any density other than the stated nameplate capacity.
- **Account for any partial charge**
  - Equipment users should account for any partial charge, the value of which should be conveyed by the OEM.
- **Use accurate measuring devices and filling techniques**
  - Ensure that all filling equipment (e.g., regulator, hose assembly) and temperature and pressure gauges used at installation are properly calibrated and accurate.
  - Gauges supplied with breakers reportedly not always accurate.
- **Confirm the filled density**
  - Ensure that equipment was filled to the stated nameplate capacity, which is determined based on density (psig/degree C) per the manufacturer's filling instructions.

Preventative Measures
Servicing and Refurbishment

- **Discontinue overfilling and underfilling**
  - Discontinue the practice of knowingly overfilling or underfilling to any density other than the stated nameplate capacity.
  - With refurbishment, clearly document any change in the internal volume of GIE, and any adjustment to nameplate capacity should be referenced through the lifetime of the equipment for servicing and retirement.
- **Use accurate measuring devices and gas recovery and filling techniques**
  - Personnel should have an understanding of the recovery process, as a significant amount of gas can remain in equipment even when the equipment is drawn down to a vacuum.
- **Confirm the filled density**

Preventative Measures
Decommissioning

- **Use accurate measuring devices and gas recovery and filling techniques**
- **Conduct a density check before recovery**
  - Measure temperature and pressure of the gas prior to recovery and compare to temperature-adjusted pressure to which GIE is supposed to be filled
  - This practice allows one to identify whether a discrepancy exists between the mass of gas recovered and the nameplate capacity, which may be due to:
    - leaks;
    - underfilling/overfilling (e.g., during the most recent servicing of the decommissioned equipment); or
    - an inaccuracy in the nameplate capacity.

Addressing Discrepancies
Installation

- **Contact the equipment manufacturer**
  - The OEM may have additional guidance that can explain the discrepancy and/or may wish to inspect the installed equipment for defects and proper filling.
- **If the discrepancy cannot be reconciled, record the mass of SF_6 used to fill the GIE to the density specified in the OEM's instructions to amend the nameplate capacity, only if it aligns with guidance received from the OEM.**
  - Clearly document in the utility's records to be referenced through the lifetime of the equipment for servicing and retirement.
  - EPA's regulation requires facilities to keep records of the data used to calculate the GHG emissions for each unit, operation, process, and activity.
    - *This includes the measurements and calculations used to determine nameplate capacity.*
- **Must consider any applicable regulation for compliance**

Addressing Discrepancies
Decommissioning

- **Deduce the correct nameplate capacity using ideal gas law to solve for the unknown**
  - Nameplate capacity = (Pounds SF6 recovered) x (Proper density SF6) / (Density SF6 before recovery – Density SF6 after recovery)
  - This calculation could be carried out if the proper density of SF_6 in the retiring equipment is well known and the actual density can be accurately and precisely measured.

- **Record the adjusted nameplate capacity**
  - Clearly document any modification in the equipment records.
  - Use modified value to override the stated nameplate capacity for purposes of estimating emissions.
  - EPA's regulation requires facilities to keep records of the data used to calculate the GHG emissions for each unit, operation, process, and activity.
    - *This includes the measurements and calculations used to determine nameplate capacity.*

Working Group Next Steps

- **Reconvene working group**
  - Distribute draft guidance to ensure the measures put forward achieve consistency and accuracy in determining and applying nameplate capacity in estimating SF_6 emissions.
- **Other**
  - Pursue case studies to provide additional insight.
  - Continue to collaborate on technical papers and ongoing research.

Thank you.

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