



Controlling Fugitive Emissions to Achieve GHG Reduction Goals

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Overview



- Fugitive Emissions: the mystery solved
- Fugitives and DOE's Greenhouse Gas (GHG) Inventory
- DOE's approach to reducing fugitive emissions
- Success stories and best practices
- Challenges and Opportunities



Tracking Fugitives across time



Fugitive, 1964



Fugitive, 1993



Fugitives, 2011



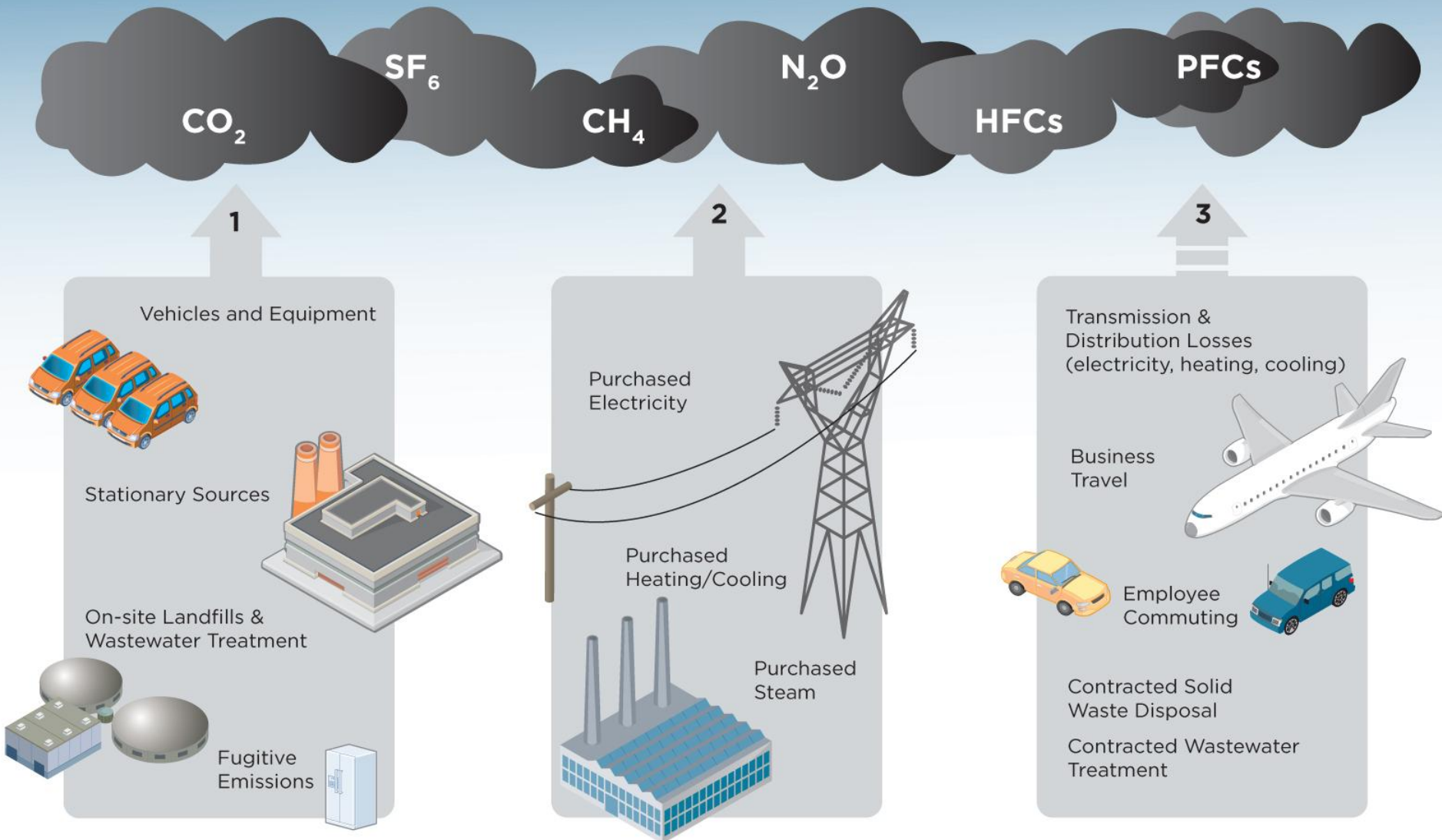


What are Fugitive GHG Emissions?



- Emissions that are not physically controlled, but result from intentional or unintentional releases of GHGs
- Arise from production, processing, storage, transmission, and use of fluorinated gases
 - Sulfur hexafluoride (SF_6)
 - Hydrofluorocarbons (HFCs)
 - Perfluorocarbons (PFCs)
 - Nitrogen Trifluoride (NF_3)
- Considered Scope 1 GHG (direct emissions), along with on-site fuel combustion

Common Sources of Federal Greenhouse Gas Emissions



SCOPE 1:

Greenhouse gas emissions from sources that are owned or controlled by a Federal agency.

SCOPE 2:

Greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a Federal agency.

SCOPE 3:

Greenhouse gas emissions from sources not owned or directly controlled by a Federal agency but related to agency activities.



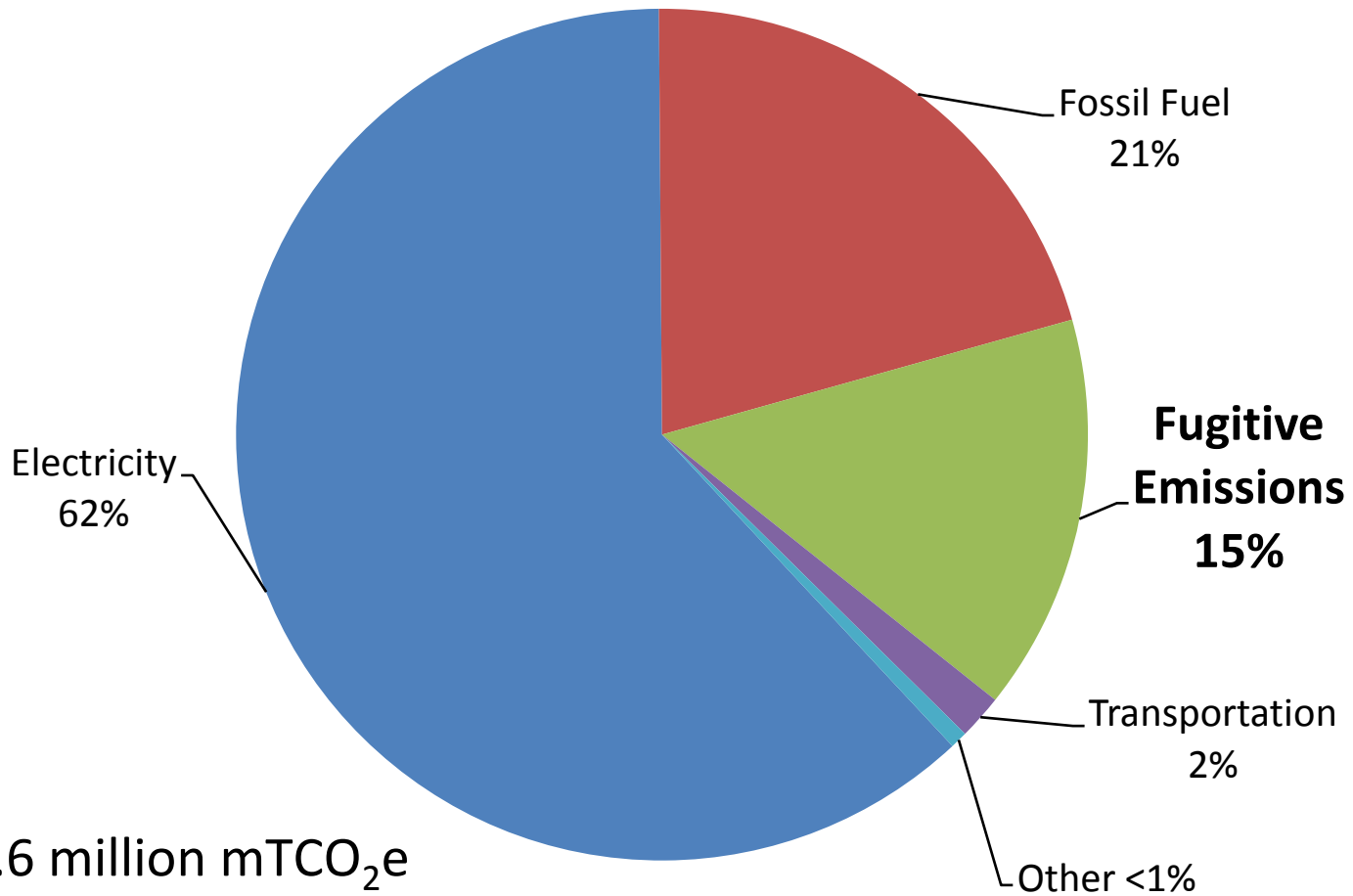
Why are Fugitive Emissions Important to DOE?



- E.O. 13514 requires Federal agencies to measure, report, and reduce GHG emissions
- Fugitive Emissions = 15% 2008 DOE Inventory of Scope 1 and 2 GHG Emissions
- Fugitive emissions reduction is highlighted in DOE's Strategic Sustainability Performance Plan (SSPP) as a key strategy for achieving DOE GHG reduction goals



DOE 2008 Scope 1 and 2 GHG Emissions Baseline (by Source)



Total: 4.6 million mTCO₂e



Where do you find Fugitive Emissions?



- SF₆ is used as an electric insulator (dielectric medium) in high-voltage electrical equipment
 - Also used as a tracer gas for equipment calibration
- HFCs and PFCs are used as blowing agents, extinguishing agents, cleaning agents, caustic gas, and refrigerants



High Impact Gases



Greenhouse Gas	Global Warming Potential (100 year time span)
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SF₆

23,900

HFC

12 – 11,700

PFC

0 – 17,340

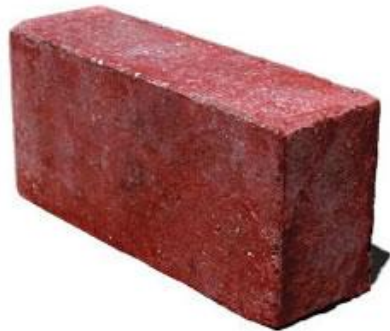
NF₃

17,200

Global Warming Potential: the ability of a greenhouse gas to trap heat in the atmosphere, relative to the same unit of carbon dioxide (CO₂).



How big is 23,900?



If this represents the global warming potential a unit of CO₂ ...



This represents the global warming potential of the same unit of SF₆

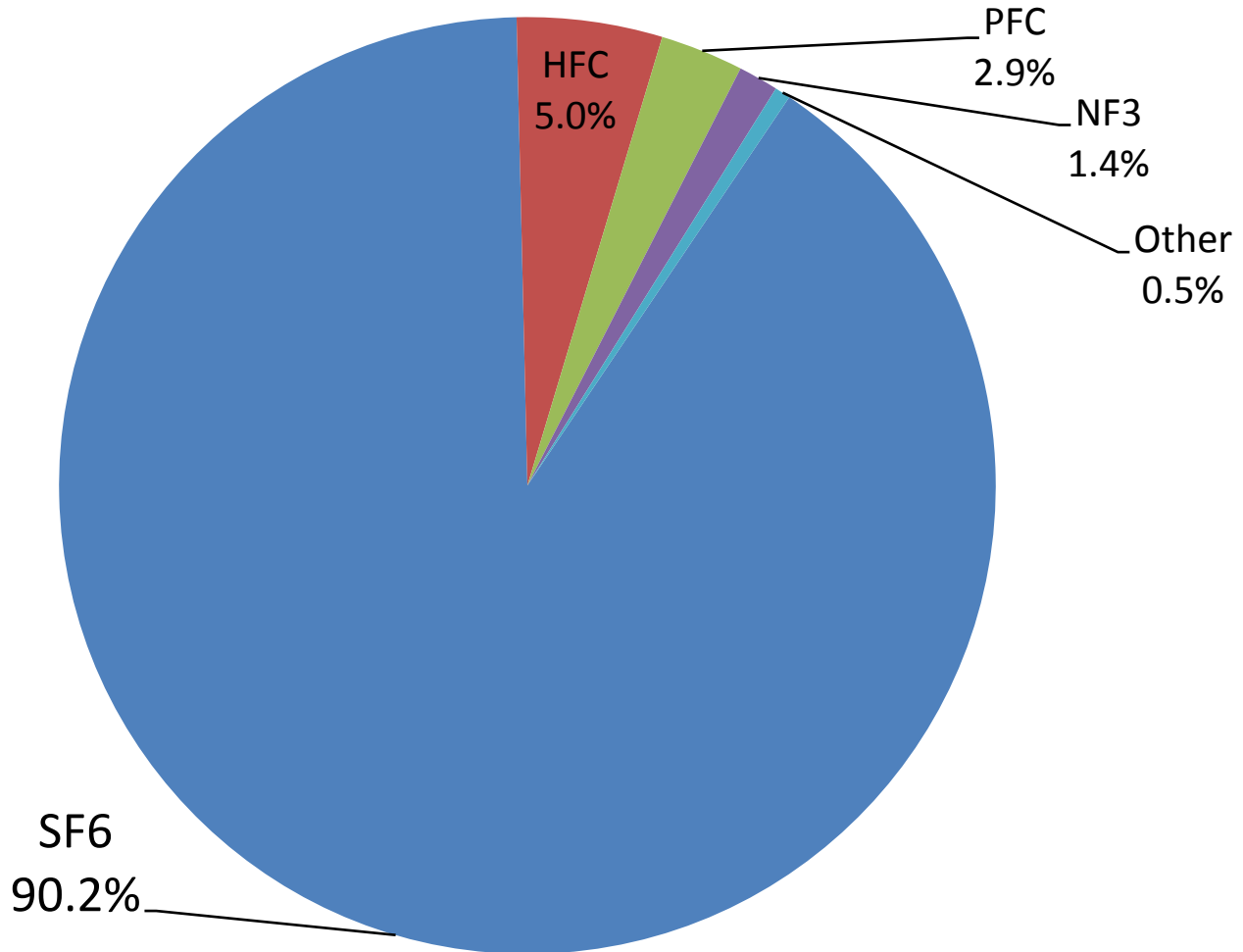


DOE Labs use Large Quantities of SF₆





DOE 2008 Fugitive Emissions by Type





DOE Goals



- Total emissions reduction (combined Scope 1 and Scope 2) by 2020 = 28%
- DOE commits to greater fugitive emissions reduction goals in its SSPP
 - By 2011 = 45%
 - By 2012 = 50%
 - By 2013 = hold
 - By 2020 = hold



DOE Implementation Plan



- Reduce SF₆ releases from maintenance actions
 - Install and use capture and storage equipment
 - Ensure personnel are properly trained
- Strengthen leak detection and repair programs
 - Focus on SF₆ systems
- Conduct opportunity assessments to identify reduction opportunities using high-GWP GHGs
 - Focus on facilities using large quantities of SF₆



Implementation Plan



- Establish Fugitive Emissions Working Group (FEWG) to share information, best practices, lessons learned
- Find an eco-friendly alternative dielectric medium that provides comparable/superior electrical insulation performance



Fugitive Emissions Working Group



- Established in September 2010
 - 25 DOE sites and organizations currently participate
- Initially focused on SF₆ emissions abatement
- Key goals of the FEWG:
 - Improve exchange of information on technologies and approaches to managing fugitive emissions
 - Identify measures to reduce leakage and improve capture of industrial fugitive gases
 - Identify environmentally preferred alternatives
 - Collect information on data collection to improve the inventory process



Substitute for SF₆ as a Tracer Gas



- SF₆ currently used as tracer gas to determine fume hood performance
- Tests indicate N₂O may be an appropriate substitute
- Brookhaven National Lab is installing and testing 126 new high efficiency, low flow lab hoods
 - Test with **SF₆ = 5,564 MTCO₂e** released
 - Test with **N₂O = 71 MTCO₂e** released



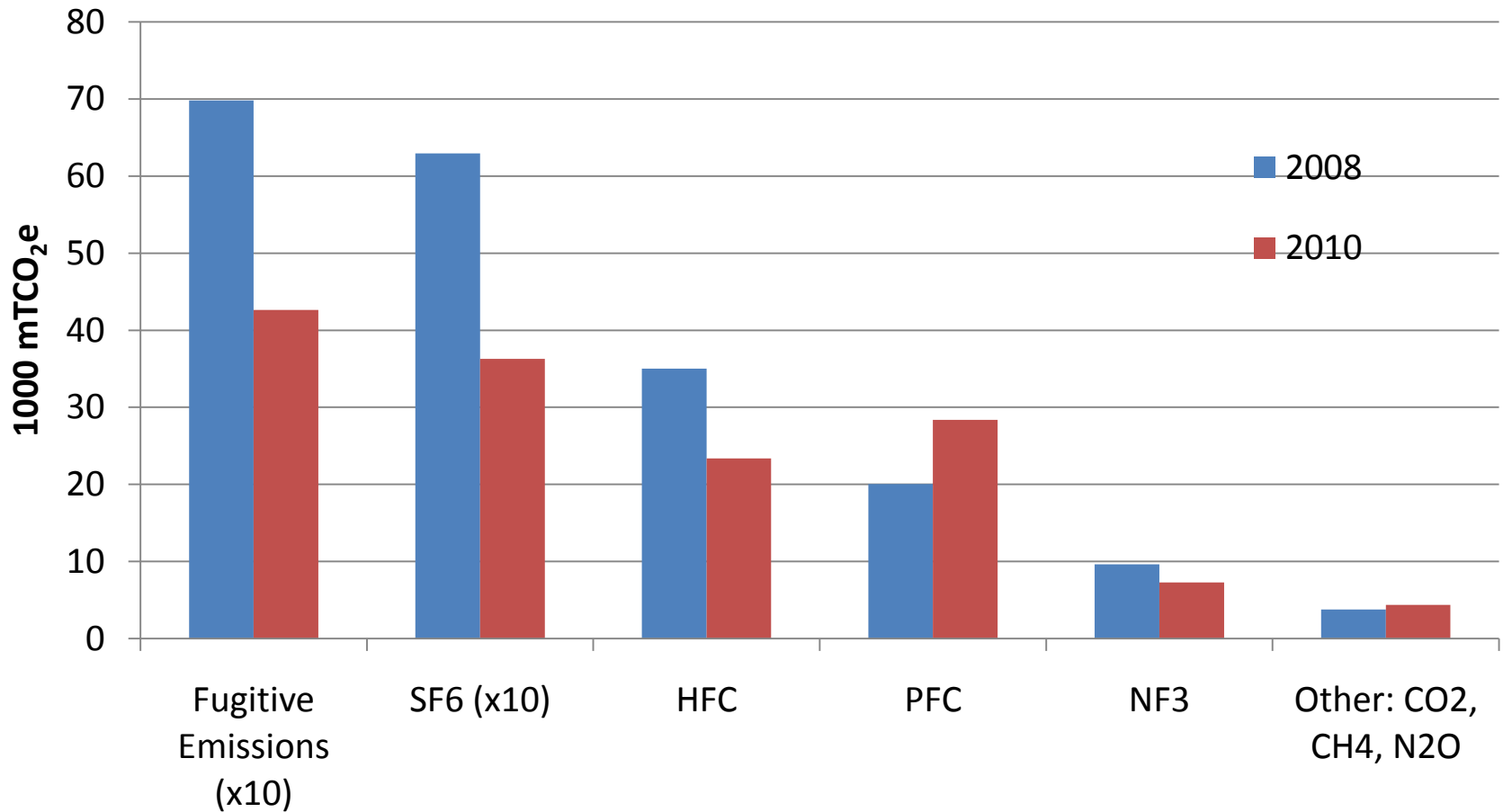
DOE Progress in Fugitive Emissions Reduction



- Fugitive emissions decreased by 39% between 2008 and 2010
 - SF₆ emissions were reduced by 42%
- Decreased total DOE Scope 1 and Scope 2 inventory by approximately 6%
 - Decrease accounted for half of the overall DOE Scope 1 and Scope 2 2010 inventory decrease of 11%



Compare Fugitive Emissions





Power Administration Best Practices



- As members of SF₆ Emission Reduction Partnership for Electric Power Systems, BPA and WAPA use the following best practices:
 - Accurate inventory tracking
 - Accurate measurements of SF₆ added to equipment using precise scales
 - Enhanced leak detection capacity (using cameras)
 - Timely leak repair
 - Implement practices to avoid unnecessary releases



Power Administration Success



- Bonneville Power Administration
 - Joined EPA Partnership program in 1999
 - Achieved and maintained emissions leak rate <1%
- Western Area Power Administration
 - Joined EPA program in early 2000s
 - Reduced leak rate from 3.2% in 2004 to 1.1% in 2009
- Power Administrations have reduced SF₆ emissions despite adding additional equipment with SF₆ to meet growing electricity demand



Best Practice: WAPA Maintenance Truck



**SF6 Gas Cart - Used for recovery, service,
and maintenance of SF6 Breakers**



**Scales used for
weighing bottles.**



Special Considerations



- Each DOE site is unique and many of the large GHG emitting processes are designed specifically for the host site.
- While there may be some similarities, the fugitive emissions reduction strategies implemented by each site will be unique.
 - Over 95% of SF₆ emissions come from nine sites
 - Over 80% of SF₆ emissions come from four sites



Challenges (and opportunities)



- SF₆ is mission-critical at several sites
 - Essential for safe and effective operation of scientific equipment and electrical systems
 - No substitutes for highest-volume applications
 - Price volatility likely as regulatory pressures increase
- Use of HFCs and PFCs will continue to increase as equipment containing ozone-depleting substances (ODSs) is phased out of service



Opportunities (and challenges)



- Relatively low-cost emissions abatement opportunities remain
 - Improve preventive maintenance and leak detection and repair
 - Continue to deploy capture and re-use technologies
- Business case for reducing fugitive emissions
 - Price volatility
 - Regulatory pressures
 - Carbon markets



Contact Information



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Backup slides

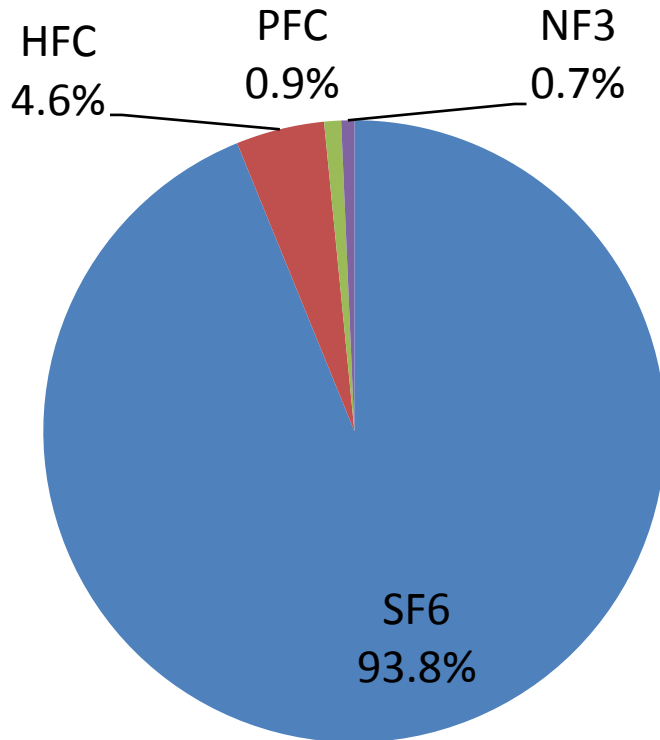




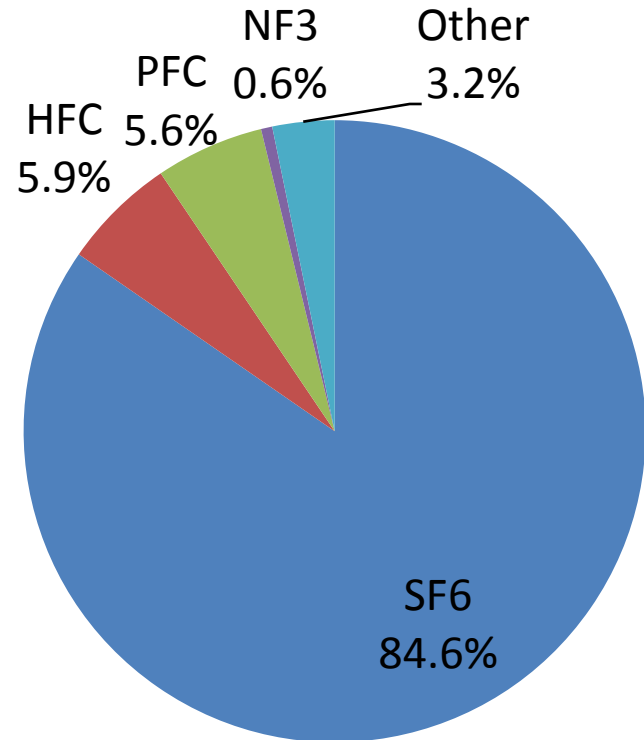
Compare Fugitive Emissions by Category



2008



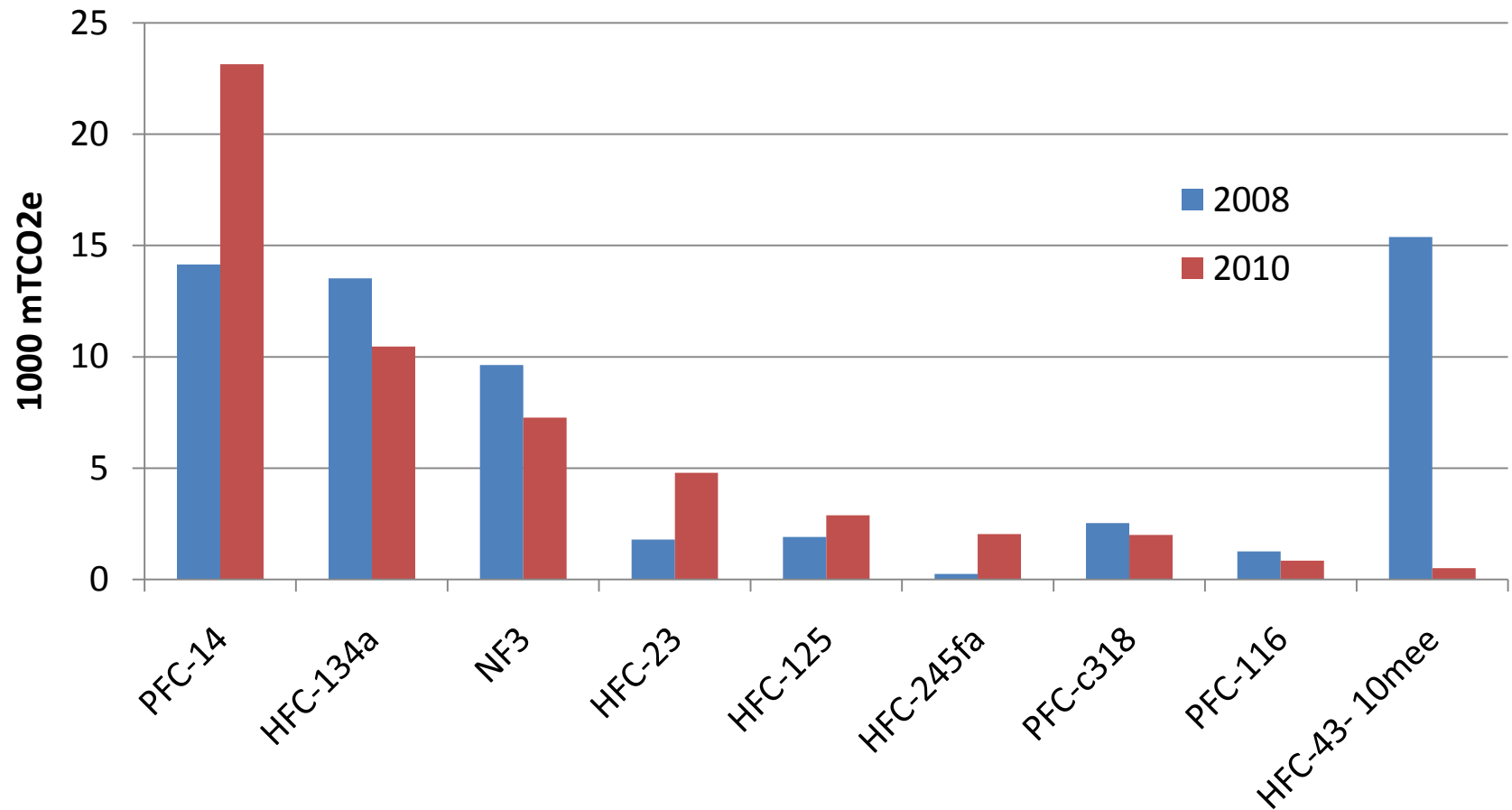
2010



Other = Fugitive quantities of CO₂, CH₄, and N₂O



Compare Non-SF₆ Emissions





DOE Fugitive Emissions: moving in the right direction

