



SF₆ Gas Management Services

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Utilities need effective tools to successfully participate in the EPA's SF₆ Emission Reduction Partnership Program. Some important tools come in the form of gas management services. Two major service areas include Training Tools and Gas Management Tools.

Training Tools

A trained employee is an effective employee. Three important training areas are:

1. SF₆ Environmental Awareness Training: This training will educate your employees about the strong Greenhouse Gas potential of SF₆ and the negative environmental impact of SF₆ emissions. Once they are aware of these issues, they will understand the importance of eliminating SF₆ leaks and emissions.
2. Safe Handling of Compressed Gases and Equipment: This important training is centered on the seven basic safety steps involved with the safe handling of compressed gases:
 - a. Know and understand gas properties. The Material Safety Data Sheet (MSDS) contains this important information.
 - b. Know and understand the gas container. The gas cylinder, if not handled properly, can be a dangerous device. Proper equipment and procedures will minimize handling risks.
 - c. Check your equipment. The gas system should be leak free and should use materials compatible with the gas being used. The MSDS and your gas supplier can provide useful information.
 - d. Develop Emergency Plans. The best time to develop this plan is before an emergency occurs. Once again, the MSDS and your gas supplier can help you draft this plan.
 - e. Provide personal protection. The MSDS will outline personal protective equipment that should be used by personnel handling the gas.
 - f. Follow the regulations. Gas handling is regulated by federal, state and local municipalities. Know what these regulations are so they can be complied with.
 - g. Know who to call. Have internal safety phone numbers, medical emergency phone numbers and your gas supplier's phone number accessible for quick contact in case of emergencies.
3. Proper Gas Cart Operation and Maintenance: Gas carts can be a major source of SF₆ emissions if they are not properly operated and maintained.



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A good gas cart training program is a proven tool to lower SF₆ releases from carts either during gas transfers or from static leaks.

Gas Management Tools

Effective gas management tools fall into seven categories:

1. Cylinder Residual Reporting
2. Gas Analysis
3. Gas Recycling
4. Gas Carts
5. Proper Cylinder Sizing
6. Customized Cylinder Delivery
7. Supplier Filling Procedures.

Each of these tools will be discussed in detail.

Cylinder Residual Reporting

Your Memorandum of Understanding (MOU) requires you to submit an annual report quantifying SF₆ emissions. The annual Reporting Form requires an accounting for SF₆ purchases/acquisitions and sales/disbursements.

One of the most important services your gas supplier can perform is the measurement and reporting of residual SF₆ in cylinders returned from your operations. The average SF₆ cylinder returned from a utility contains @ 12% of the original product. That means a full cylinder containing 115 pounds of SF₆ received by the utility will be returned with @ 14 pounds of product. If the utility uses 100 SF₆ cylinders per year, product coming back in the “empty” cylinders will total 1,400 pounds. This is the equivalent of 12 full cylinders of product.

If you do not adjust your purchases to account for this returned product, it will be accounted for as an emission on your Annual Reporting Form. Therefore a Residual Reporting System is an extremely important gas management tool to reduce reported emissions.

Gas Analysis

Knowing the quality of SF₆ insulating gas in your equipment allows you to reduce your equipment failure rate and lower maintenance costs.

Under arcing conditions, SF₆ absorbs large amounts of energy dissociating into SF₅ + F. Most of the gas “self-heals” after the arcing stops but recombination is



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not always complete. If air and/or moisture are present during arcing, some of the SF₆ will permanently decompose which will compromise your equipment performance.

Critical contaminants in SF₆ include:

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| 1. Air | 6. Sulfuryl Fluoride (SO ₂ F ₂) |
| 2. Carbon Dioxide (CO ₂) | 7. Oxygen |
| 3. Carbon Tetrafluoride (CF ₄) | 8. Nitrogen |
| 4. Carbonyl Sulfide (COS) | 9. Moisture |
| 5. Thionyl Fluoride (SOF ₂) | 10. Oil |

A valuable gas analysis service will allow you to extract a gas sample from the equipment while it is in service. This sample will be sent to a laboratory equipped with the proper analytical instruments. This service should provide the following:

1. Fast results, which will allow for proper and timely action.
2. Historical tracking of gas quality in individual pieces of equipment, which allows you to monitor equipment performance over time and schedule timely preventative maintenance.

Gas Recycling

Prior to the higher level of awareness of SF₆'s Greenhouse Gas properties, used SF₆ was vented to the atmosphere. This is no longer an acceptable processing method. Many utilities are proud "owners" of used SF₆ cylinder "graveyards."

These cylinder hoards create big problems:

1. They are a space problem.
2. They are a safety hazard.
3. They are a potential SF₆ emission source.

SF₆ recycling is the proper way of processing contaminated product. Some of this gas can be processed with gas carts. Some may require bolder recycling action. A major gas recycling project requires a well-defined Project Scope and an appropriate Project Budget. It is important to partner with a company with extensive expertise and capabilities including:

1. Onsite technical assistance and support.
2. Mobile equipment for onsite purification or onsite packaging for proper removal to an offsite purification system.

Full circle product stewardship is important.



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Gas Carts

Improperly maintained gas carts are a major source of SF₆ emissions. Carts are sophisticated systems with many potential problem components such as vacuum pumps, compressors, fittings and hoses. Proper training is an important tool to maintain leak-free, well operating gas carts.

The purchase of gas carts can be a large capital expense. It may be wise to consider a gas cart rental option. Benefits of renting equipment include:

1. Rental costs can be accounted for as Operating Expenses rather than Capital Expenses.
2. Cart rental allows you to have the cart onsite only when you need it.
3. Cart rental eliminates cart maintenance issues.

Proper Cylinder Sizing

SF₆ gas is available in multiple cylinder sizes providing flexibility for different gas requirements.

1. Larger cylinders should be used for single site or stationary requirements. This will minimize the number of cylinders required for the job.
2. Smaller cylinders should be used for mobile requirements. It is safer to handle lighter weight cylinders and will result in more efficient utilization of the cylinders.

Customized Cylinder Delivery

Most utilities have several, if not many, different locations requiring delivery of SF₆ gas. Your gas supplier can work with you to customize a delivery system to achieve three important goals:

1. Minimize “touch” labor: By minimizing the number of times your employees touch cylinders you improve overall safety and lower cylinder handling costs.
2. Minimize cylinder inventories: Having fewer cylinders in circulation will lower your cylinder rental expenses.
3. Maximize gas utilization from each cylinder: You will end up purchasing fewer cylinders which will lower your gas purchase expenses.

Supplier Filling Procedures

It is important for you to know how your gas supplier handles residual SF₆ contained in the cylinders you send back. There are two possibilities:

1. Vent and refill: If your supplier is using this method, they are removing all residual SF₆ from the cylinder prior to refilling with virgin product. If the removed residual is handled correctly, it is collected, tested and reused. If



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handled incorrectly, it is vented to atmosphere. Always insure your supplier is not venting residual product to atmosphere because of the detrimental environmental impact of such a procedure.

2. Use of Residual Pressure Valves (RPV): RPVs have a check valve integral to the cylinder valve. This configuration provides two major advantages:
 - a. The use of the RPV insures no contaminants can be backfilled into the cylinder at the point-of-use.
 - b. The use of the RPV allows the supplier to top-fill virgin product on the uncontaminated residual thereby eliminating the need to extract residual product and potentially venting it to atmosphere.

Conclusion

Using the many SF₆ gas management tools discussed in this presentation can provide important benefits to many stakeholders in your utility's operation:

1. Employees will benefit from **improved safety**.
2. Management and shareholders will benefit from **lower operating costs**.
3. The USEPA and the global environment will benefit from **lower actual and reported SF₆ emissions**.